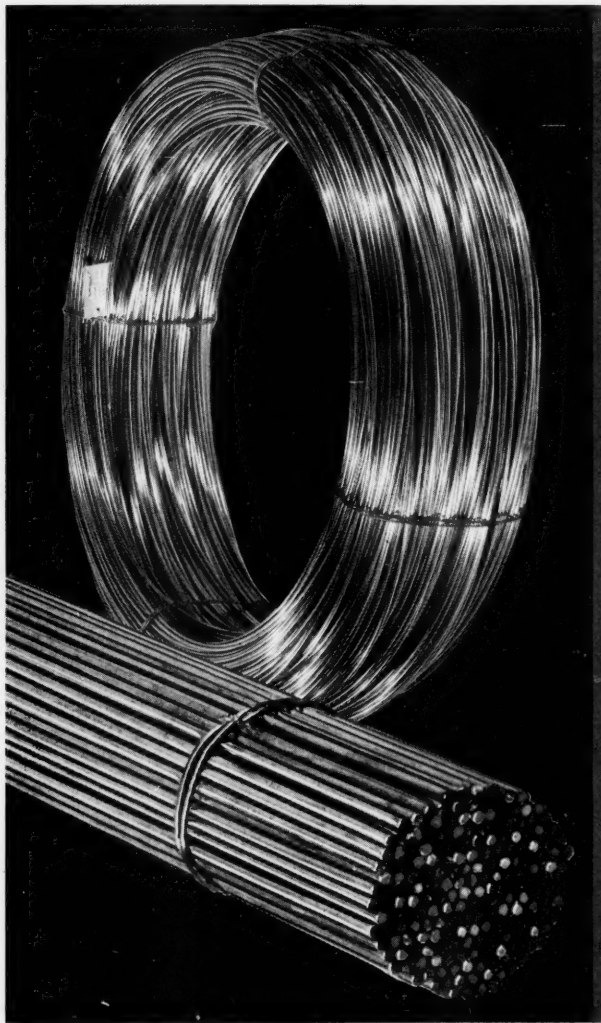
WIRE AND WIRE PRODUCTS

JUNE 1938



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OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

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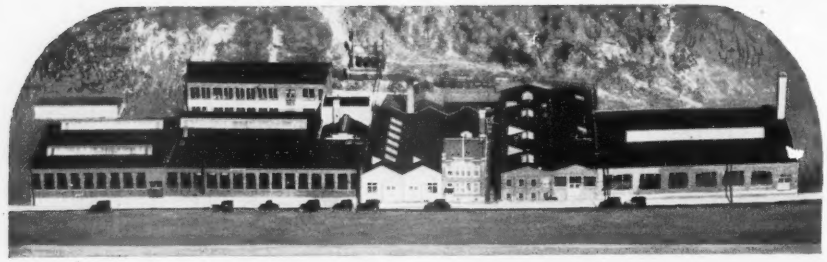

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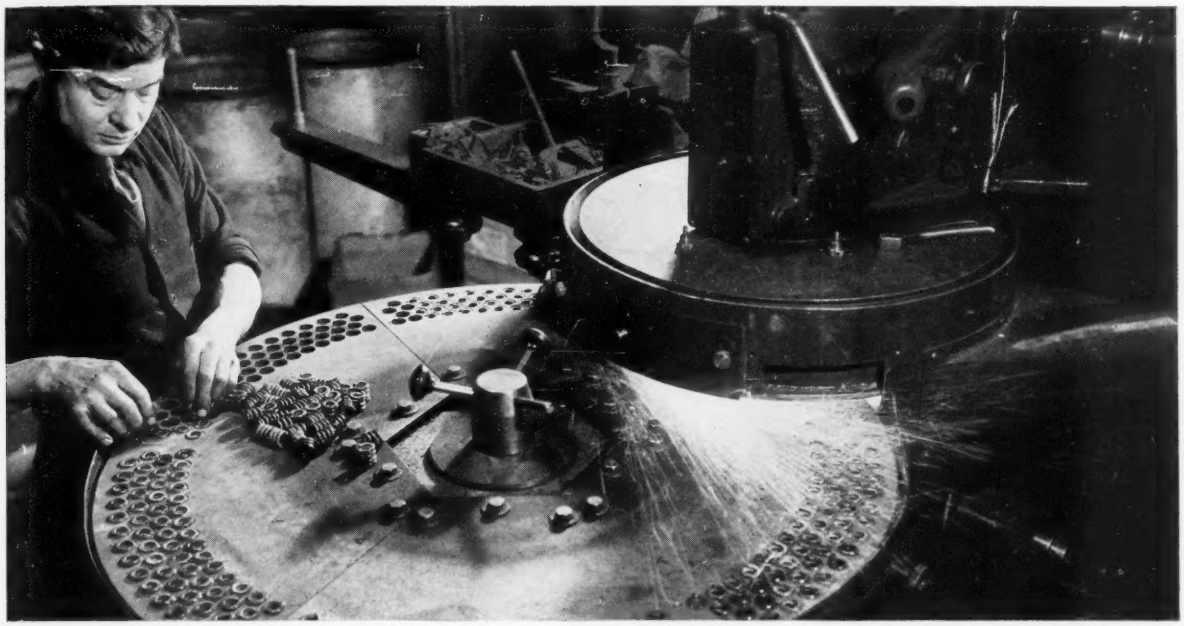

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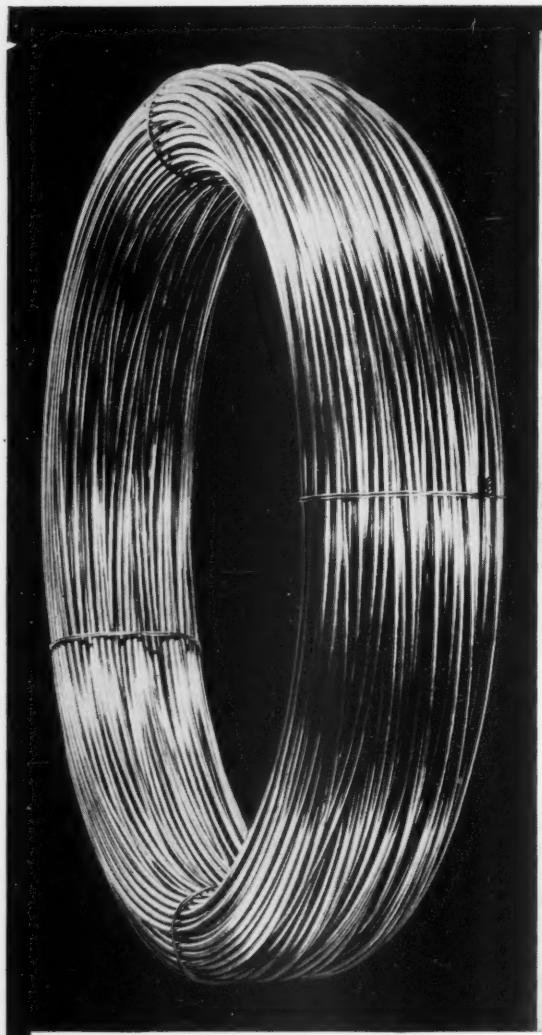

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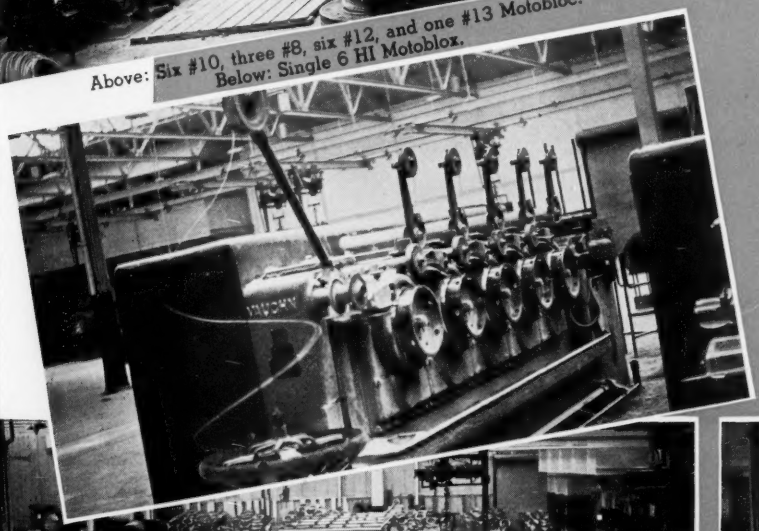
Above: Six #10, three #8, six #12, and one #13 Motobloc.
Below: Single 6 HI Motoblox.



Pictured herewith are four views of the modern wire mill of Guest, Keen & Nettlefolds, Ltd., Cardiff, Wales.

This company, with plants in England and abroad, manufactures screws, bolts, nuts, nails and sundry wire products.

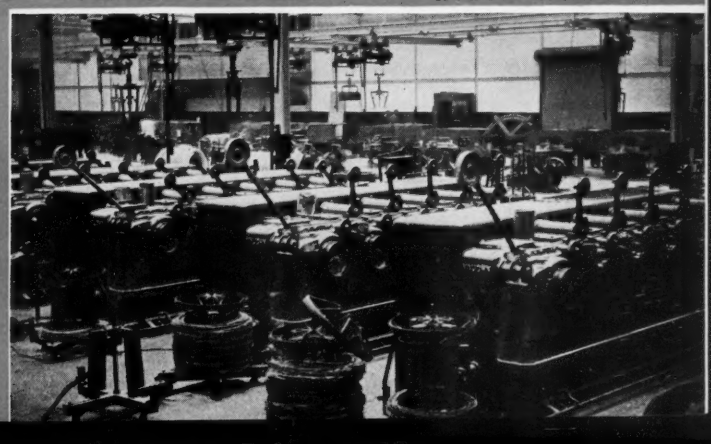
The wire mill illustrated is adjacent to their rod and other steel mill operations, and supplies practically all of the wire requirements of their various English plants.

Sixteen Vaughn Motoblocs and eleven Vaughn Motoblox were installed in this modern mill early in 1937, and the performance and productions are fully up to expectations —typical of Vaughn installations.

THE VAUGHN MACHINERY COMPANY
CUYAHOGA FALLS, OHIO

Below left: Three 3-HR, two 5-HR and six 6-HI Motoblox.

Below: Closeup of a group of six 6-HI Motoblox.



TENTATIVE PROGRAM
STEEL DIVISION
FOR WIRE ASSOCIATION CONVENTION AT DETROIT, MICH., OCT. 17-21, 1938

Day and Session	Subject	Day and Session	Subject
MONDAY Morning 9:30 A. M.	Registration	WEDNESDAY Morning 9:30 A. M. 11:00 A. M.	Lecture: Thermal Reactions Wire Association Annual Meeting
Afternoon 12:30 P. M.	Directors and Program Committee Luncheon	Afternoon 2:00 P. M.	Acid Disposal Symposium
TUESDAY Morning 9:30 A. M.	Lecture: Principles of Metallurgy Wire Screens—Uses and Grades	THURSDAY Morning 9:30 A. M.	Lecture: Metallurgy of Steel Wire Stainless Steel Wire
Afternoon 2:00 P. M.	Cold Drawing Cold Heading	Afternoon 2:00 P. M.	Rope Wire Wire Rope

Program of the Non-Ferrous Division Will be Announced in July Issue of Wire and Wire Products

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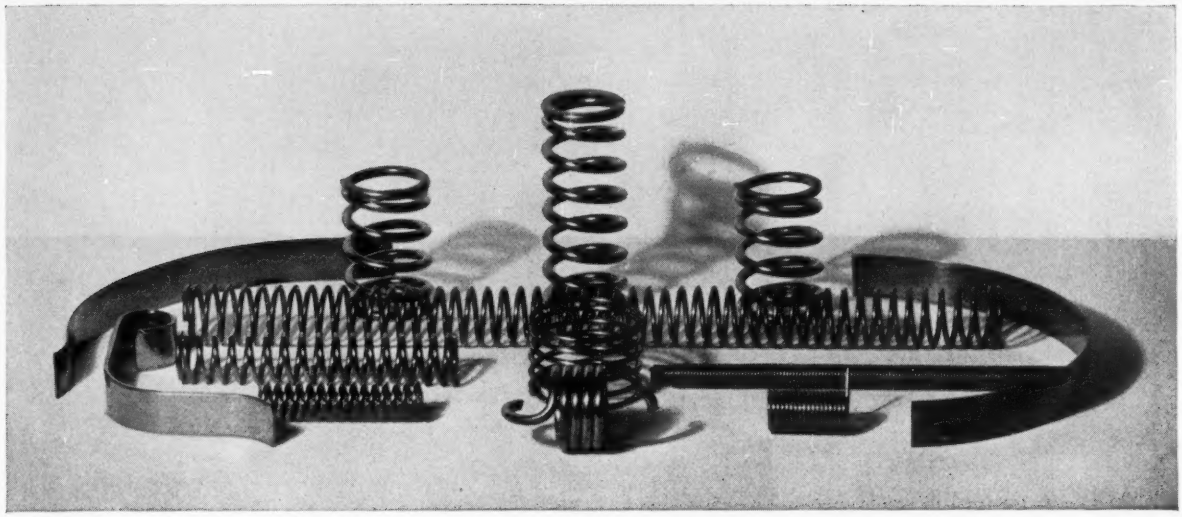

What if Springs were Illegal!

SUPPOSE, by a wild stretch of the imagination, springs should suddenly be prohibited in product design ! Industrial efficiency would snap back into the Middle Ages! So vital is the spring that almost every mechanism must contain one or more. A long ride in an unsprung automobile would be misery. Without springs, the gas engine, typewriter, vacuum cleaner, and thousands of other everyday items would have to be completely redesigned. Without springs, we might still be telling time by the water clock, printing newspapers on a "Franklin" press, and reading them by a kerosene lamp!

Yet, in the name of economy, important products are still being equipped with springs which fall easy prey to corrosion and rapid loss of resiliency—two things which can be COUNTED on to shorten service life ! Saving a few cents a pound on springs at the expense of performance is no more economical than mixing sand with sugar or water with milk—the net is usually the loss of a customer.

Many a manufacturer, product designer, engineer, has sidestepped spring trouble by specifying springs of Seymour Phosphor Bronze, because this alloy has such unusual qualities.

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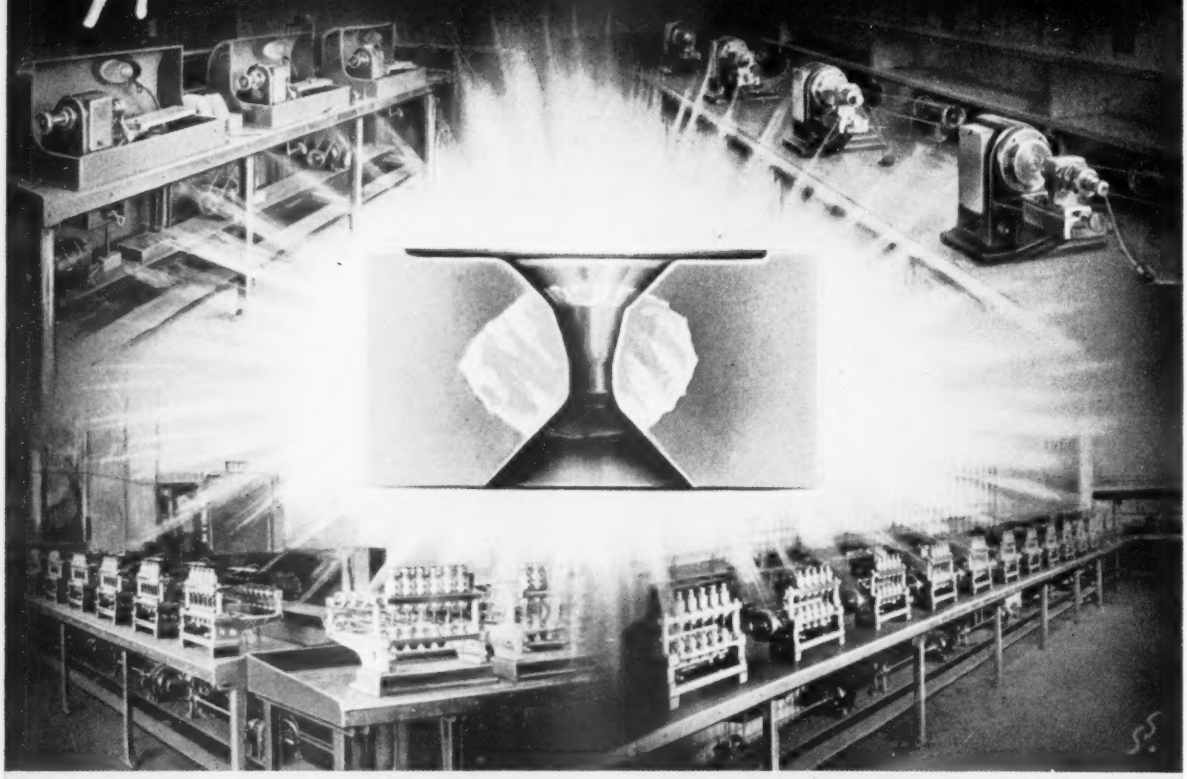

Only with Master precision machinery can a diamond die be produced with definite angles, lengths of bearing and excellence of polish. By the use of automatic drillers, polishers and finishers and other machines of our own design and manufacture, we are enabled to produce a better diamond die at a lower cost to the wire drawer than it was possible to obtain heretofore. Hand labor with its personal factor is almost entirely eliminated. Consequently duplication of a given shape is assured without the added cost of reshaping and polishing which would obtain in a hand-made die.

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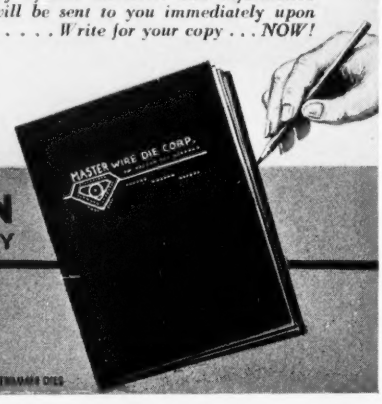
Your copy of this attractive and informative catalog will be sent to you immediately upon request . . . . . Write for your copy . . . NOW!



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WIRE AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable

DRAWING—ROLLING—EXTRUDING—FORMING—FABRICATING

Vol. 13 JUNE, 1938 No. 6

Designated as

Official Publication By The Wire Association

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Publication Office: Washington, N. J.
Executive Office: 17 E. 42nd St., New York, N. Y.
Annual Subscription, U. S. $5.00, Canada $5.00
50 Cents a Copy Issued Monthly Foreign, $7.50

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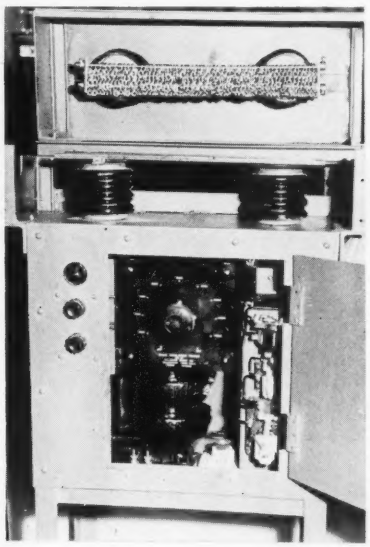

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WIRE AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip.
Wire Products and Insulated Wire and Cable.
DRAWING --- ROLLING--- EXTRUDING --- FORMING --- FABRICATING

Vol. 13 JUNE, 1938 No. 6

An Important Factor in the Production of Bright Copper Wire

By Robert C. Williams,
Chief Chemist, The Ironsides Co., Columbus, Ohio

A discussion of the effects of different types of lubricants on the finish of bright copper wire. Most materials useful in compounding lubricants rarely produce discoloration due to their own independent action. ✦ ✦

THERE are doubtless many factors which determine whether bright copper wire will result as the finished product of any copper wire mill. Some of these factors are known, while others offer some difficulty in tracking down and understanding.

✦ ✦ ✦

WHEN wire is being produced, which is not satisfactory from a color or brightness standpoint, the first shout that goes up is "the lubricant or 'dip' is haywire." At least that is the shout the wire drawing lubricant people hear first, and, no doubt, the annealing furnace people claim the first shout is "the atmosphere is screwy."

✦ ✦ ✦

IN either case there may be faulty lubrication or annealing or something else to blame.

✦ ✦ ✦

IN our study and development of wire drawing lubricants, it was natural that we should investigate various raw materials from the discoloration viewpoint. In selecting components, such as oils and fats, for wire drawing lubricants, we adopted the procedure of deliberately coating bright copper wire with the component in question and subjecting it to annealing temperatures up to approximately 1,000° F. in a steam atmosphere. This can be done very simply in the laboratory by putting the treated wire in a pyrex tube, and passing steam or inert gas through the heated tube. Likewise, the finished product is tested.

✦ ✦ ✦

IT was indeed surprising to find that most materials useful in compounding lubricants rarely produce discoloration, due to their own independent action. Oils or fats containing sulfur either free or loosely combined chemically have, of course, produced discoloration under the conditions outlined above. Such oils or fats naturally would not be considered as useful possibilities having a knowledge of their sulfur contents in the first place.

WHY, then, can lubricants be blamed for the discoloration of wire? The answer appears to be in the deposition or development of an appreciable film of the reaction product, copper soap, resulting from the chemical combination of the copper (or more than likely, copper oxide) and the fatty acid always present in any soluble lubricant solution containing fats, fatty oils, soaps, sulfonated oils and the like. Copper oleate, a typical copper soap, rubbed on copper wire which is annealed in accordance with the above experimental procedure causes a blackening of the wire. Decomposition of the copper oleate into black copper oxide is presumably the basic reason for this discoloration as this decomposition reaction is known.

✦ ✦ ✦

FURTHERMORE, bright copper treated with fatty acids or fats containing free fatty acid becomes green as copper soap is formed on ageing at room temperature. When wire treated and aged in this way is annealed, a black discoloration is produced.

✦ ✦ ✦

GETTING back to the relation of this copper soap to lubrication,

it is well established that fatty acid occurs in all of the lubricant solutions containing fats and soaps. This is due to normal hydrolysis of soaps and fats in the presence of water. The action of carbon dioxide or acid fumes also produce fatty acid. It is generally agreed that a certain amount of fatty acid in the drawing solution is highly desirable if not actually necessary for good lubrication. The question arises as to how to proceed to control the amount of fatty acid present in a drawing solution. Three checks are required. One is the control of fatty acid content in the compound by the manufacturer. the second is the control of the alkalinity or pH of the drawing solution and the third is the control of the actual concentration of the lubricant compound in the drawing solution. Any one of several pH measuring devices may be used to determine the pH of a solution while the Babcock test is probably the simplest and best method for determining the total concentration of soap and fat in the solution. The lower the alkalinity or pH value is—the higher the fatty acid content in the solution. The higher the fatty acid content—the greater is the tendency to form copper soap.

✦ ✦ ✦

THE problem of actual control of the pH is simplified by the use of compounded lubricants which automatically give the proper pH range as additions of compound are made to maintain the optimum operating strength.

✦ ✦ ✦

WHEN drawing solution becomes contaminated by pickling acid remaining on the rods, the alkalinity or pH naturally drops and normal additions of compound cannot be expected to overcome serious contamination. In such cases, it is necessary to adjust the pH to the proper range by adding an alkali such as caustic soda or potash. The addition of these alkalies must be made in small quantities in order to avoid raising the pH too high. It is well to start with 2 ounces of caustic per 100 gallons of drawing solution, repeating this addition till the pH has been raised sufficiently. To avoid localized high pH values, it is preferable to make the addition of caustic to the reserve tank—not directly to the machine.

✦ ✦ ✦

IN dealing with the question of what is the proper pH range, there is some difference of opinion. In general, the pH should not be below 8 or over 10.5 and possibly the range 8.5 to 9.5 is preferable in most cases for coarse, medium and fine wire solutions, regardless of the analysis of solution. A change of 1 pH unit means a 10 fold change in actual alkaline strength, because pH is defined as the logarithm of the reciprocal of the hydrogen ion concentration. PH control is therefore not a particularly delicate operation when a range of one or two pH units is concerned. A drawing solution having a pH of 8 or less generally has more green or bluish cast, due to finely dispersed copper soap, than a solution of higher pH. Copper soap, itself, has good lubricating action, but this "benefit" is offset by dirtier wire, solution instability and mucky solutions. Copper dust, produced in all copper wire drawing jobs, is more responsible for the production of copper soap in the drawing solution than is the wire itself, due to the fine state of dispersion of the dust in the solution.

✦ ✦ ✦

A FRESHLY made up solution of compound often has a pH of 9.5 or even higher, depending on the pH of the water used and, of course, the nature of the lubricant compound. The initial pH value drops rapidly with use, due largely to the effect of carbon dioxide from the air and acid fumes some times present in the air. The drop in pH is ordinarily not as low as 8.0 before a normal operating addition of compound is made.

✦ ✦ ✦

IT is advantageous to anneal wire as soon as is convenient after drawing to avoid the formation of copper soap due to the action of traces of fatty acid, most certainly on the wire, combining with the copper over a period of time.

✦ ✦ ✦

Summary

1. **The failure to produce uniformly bright wire is frequently attributed to the lubricant.**
2. **Most lubricant components as such do not discolor copper wire.**
3. **Copper soap, produced by the action of fatty acid on copper, does blacken wire during annealing.**
4. **Fatty acid, which normally exists in lubricant solutions, can be controlled to minimize the development of copper soap.**
5. **Control of the fatty acid content can be accomplished by a knowledge of the alkalinity of the lubricant solution.**

Make Your Plans Now To Attend

THE ANNUAL WIRE ASSOCIATION MEETING AND CONVENTION

To Be Held In Association With The

NATIONAL METAL CONGRESS

At DETROIT, MICH. OCTOBER 17th to 21st, 1938

There Will Be A Registration Fee of $5.00

Admission will be by Badge Only

Bethlehem's New Continuous Rod And Bar Mill

A description of the new 10 inch rod and bar mill recently completed at the Sparrows Point, Md., plant of the Bethlehem Steel Company. ✦ ✦

EMBODYING a variety of new features and modern improvements, the new continuous rod and merchant bar mill at the Maryland division of Bethlehem Steel Company strengthens the position of this plant as one of the most up-to-date integrated units for the production and manufacture of steel in the country.

✦ ✦ ✦

HIGH quality production is insured in this modern mill, where a No. 5 rod, nearly a mile long, is delivered to the reels in about 60 seconds, emerging from the last stand at a speed of about 4000 ft. per minute, or nearly 46 miles per hour. Close tolerances, accuracy of contour, and improved physical properties are directly attributable to this high speed operation, and to the Morgoil bearings mounted on the tapered necks on all the stands. The improved quality and greater length of the rod also offer important advantages in subsequent wire drawing operations.

✦ ✦ ✦

TOGETHER with the older 17 stand No. 1 unit the new, or No. 2 mill, will supply rod from No. 5 up to and including $\frac{3}{4}$ in. diameter for the local wire mills. Production in excess of local requirements is available for the market. The new mill is also equipped to produce concrete reinforcing bars, in sizes from $\frac{3}{8}$ in. up to and including 1 in. square, as well as accurate merchant rounds and squares.

✦ ✦ ✦

ALTHOUGH the first fifteen stands are designed for the simultaneous rolling of four strands of rod, the mill is not yet fully equipped for this operation. At the present time only one two-strand finishing train has been installed. Addition of a second train, with coilers and conveying equipment, is the only requirement for full, four-strand production, when an output of over 20,000 gross tons of rod per month will be available. The present two strand capacity is about 12,000 gross tons per month.

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BILLETS are received in standard lengths of 30 ft., from $1\frac{13}{16}$ in. to 3 in. square. They are stored in a billet yard where over 12,000 tons, made up of forty or more grades, are regularly kept on hand. The billets are first brought to rolling temperature in a heating furnace of the suspended arch type, with an effective hearth area of 30x50 ft., and an hourly capacity of 50 gross tons. The furnace is fully inclosed in a steel case, with insulating lining, and is fired either by oil or gas. Temperature regulation is fully automatic.

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AS a billet is fed into the upper end of the furnace the entire row of billets is pushed down the inclined furnace bed, toward the firing end. Thus the billets are heated slowly and uniformly until they reach the proper rolling temperature. One by one, as they are needed, they are then pushed out of the furnace, at the lower end, into the rolls of the first roughing stand.

Fig. 1. Billet Yard.

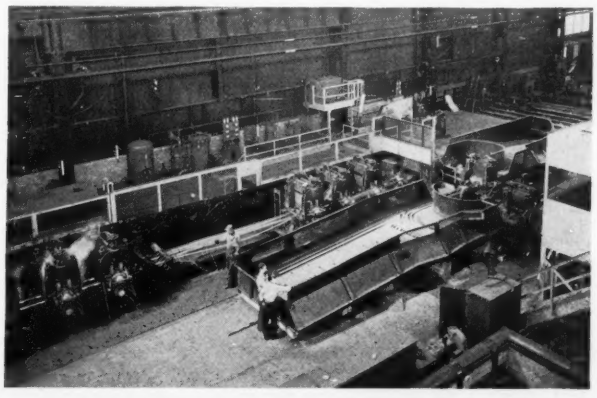

Fig. 2. Last roughing stand, intermediate roughers, and looping stand.

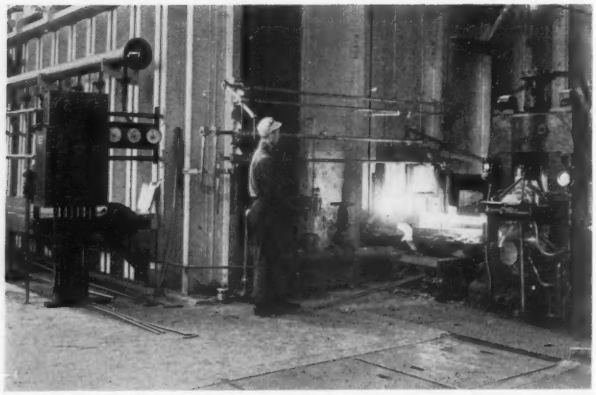

Fig. 3. Discharging rolls from heating furnace to first roughing stand.

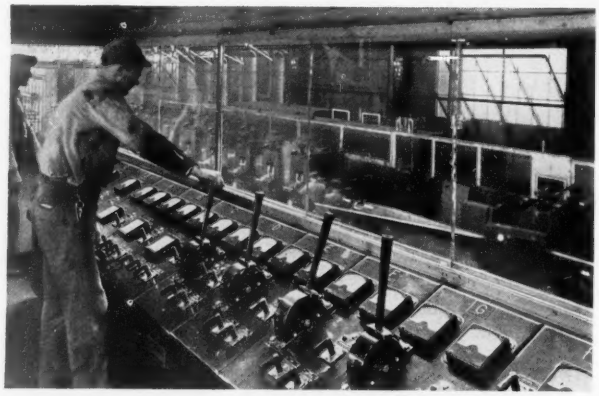

Fig. 4. Pulpit overlooking roughing stand.

THE mill has 21 stands, divided into nine roughers, four intermediate roughers, two looping stands with repeaters, and six finishing stands. All stands are equipped with Morgoil bearings.

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DUE to the special provisions for accurate vertical, horizontal, and longitudinal adjustment of the rolls and because the oil film bearing does not wear, very accurate alignment of the passes can be maintained and a high precision in the product obtained.

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ALL mills have forged steel pinions with cut and case hardened helical teeth. The mill pinions and the bevel speed up gears of the finishing mills are of the same type. The bevel gears have spiral teeth and the gear reduction sets have herringbone teeth. All rolls are equipped with duplicate passes across the face, varying in number according to the size.

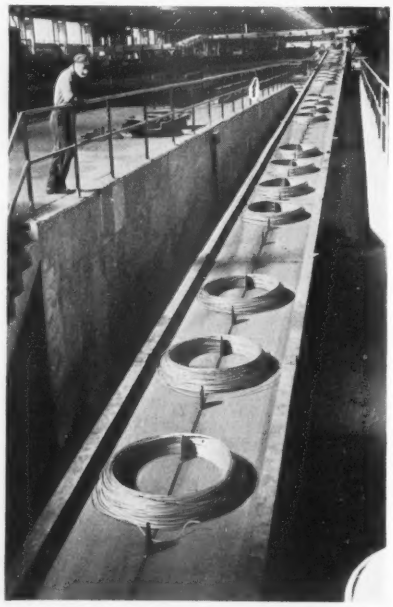

Fig. 5. Chain Conveyor. ✦ ✦

THE two looping stands are connected with each other and with the intermediate roughers and the finishing train by four strand repeaters. An important function of these repeaters is to provide slack to keep pull out of the rod at this stage in rolling. This insures an accurate contour and close adherence to the desired finished size.

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MAXIMUM reduction in any pass does not exceed 35 per cent, while the minimum is 9 per cent, in the last pass. Rolling speeds vary from about 6 r.p.m. in the first roughing stand to 1500 r.p.m. at the last pair of rolls. A billet passes through all stands in about 60 sec. Due to the high speed of operation the temperature drop during rolling is low, not more than about 300 deg. This insures closer tolerance and uniform physical properties of the rod. The first two passes are oval; this

Fig. 6. 270 ft. double-sided bar cooling beds, hook conveyor for rod bundles at right. ✦ ✦ ✦ ✦ ✦ ✦

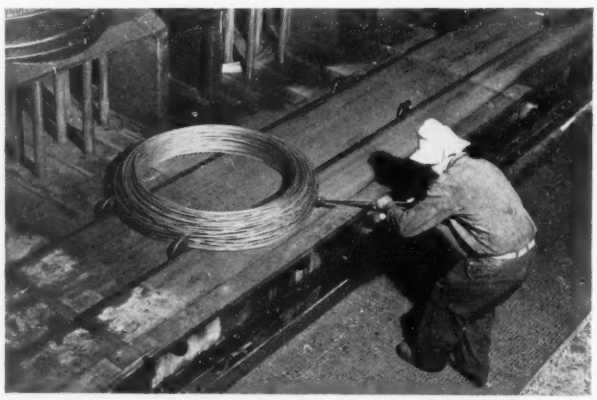

Fig. 7. 4 laying reels for coiling rod up to ¾-in. diameter. ✦

is followed by a round pass. Thereafter the passes are alternately oval and square up to the last stand, which naturally is round. Heavy rod and reinforcing bars are finished on the 15th stand which then operates with a round or a square pass, as required.

✦ ✦ ✦

FROM the finishing train the rod is delivered to four reels by specially designed, water cooled connecting pipes. A descaling device removes part of the scale at this point, while a system of spray nozzles controls the temperature of the rod. Water eliminators following the sprays remove surplus water before the rod reaches the reels, which are of the laying type, that is, a reel head revolves above a stationary coil plate and deposits the stream of hot rod between two rows of pins. Coils of 46 in. outside and 34 in. inside diameter are formed on the coil plate; when completed these are transferred horizontally by a motor operated pusher to a 330 ft. continuously running conveyor. An automatic switching device directs the rod from one reel to the next without delay between successive rod lengths.

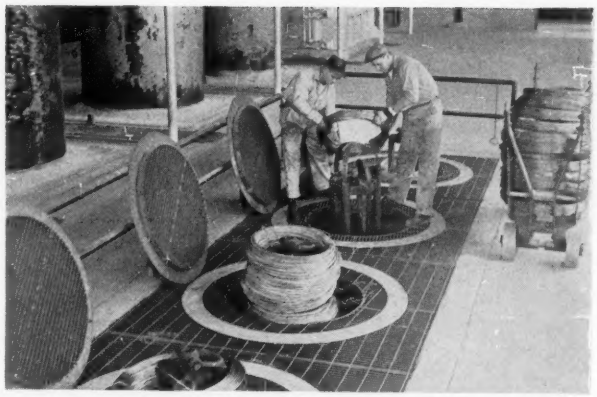

Fig. 8. Assembling coils of rod in lifts for annealing furnaces. ✦

✦ ✦ ✦

THE rod finishing mill is used for rods in sizes up to ⅜ in. diameter. Rods of this size and larger are finished in the 15th roll stand and delivered to two pouring reels in which the rod is directed onto a revolving coil plate through a stationary nozzle. The bundles formed on these reels are of the same dimensions as those made on the laying reels and are transferred to the same chain conveyor.

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AFTER travelling the full length of the conveyor the bundles are transferred to a hook carrier which takes them to the storage or to the loading platform. Convenient opportunity is provided for inspection, trimming, and tying the rod bundles in transit.

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BARS to be sheared into straight lengths are also finished on the 15th stand; they are delivered by a hot run-on table extending from this stand to a 270 ft. double sided cooling bed. Special automatic shearing equipment is provided in the run-on table for cutting the bars into lengths suitable for the cooling bed. The surface of the bed is of the notched, carry-over type, consisting of stationary and moving racks. All notches of the cooling surface are accurately machined to insure proper alignment of the bars during cooling.

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THE cooled bars are assembled into groups which are transferred mechanically to cold run-off roller tables leading to the stationary bar shears and back shear tables. Bar bending equipment for reinforcing bars includes two heavy bar benders and one stirrup bender.

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THE annealing equipment consists of four radiant tube furnaces and twelve bases with inner covers, or shrouds. The outer covers have sprung arch roof, constructed of ½ in. plates braced by H-beam columns and lined with light weight insulating material. Inside along each side, and extending from both ends toward the center are three tiers of horizontal hairpin tubes of heat resistant alloy. These rest freely on brackets to permit expansion and contraction; the open ends are securely bolted at the opening in the outer casing. A mixture of coke oven and blast furnace gas, of about 500 B.t.u., is burned in the tubes.

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CORRECT temperature is maintained by automatic air fuel ratio control. A thermocouple inside the inner cover, at the approximate center, is used for this pur-

(*Please turn to Page 324*)

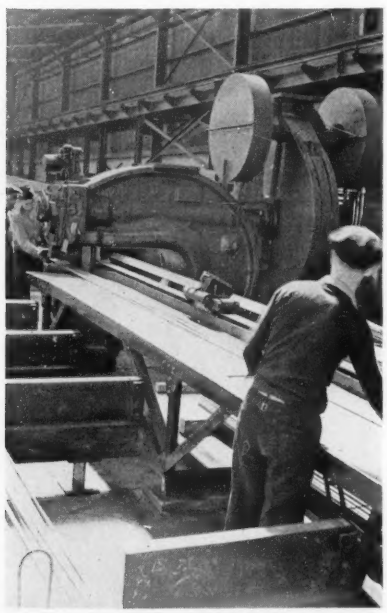
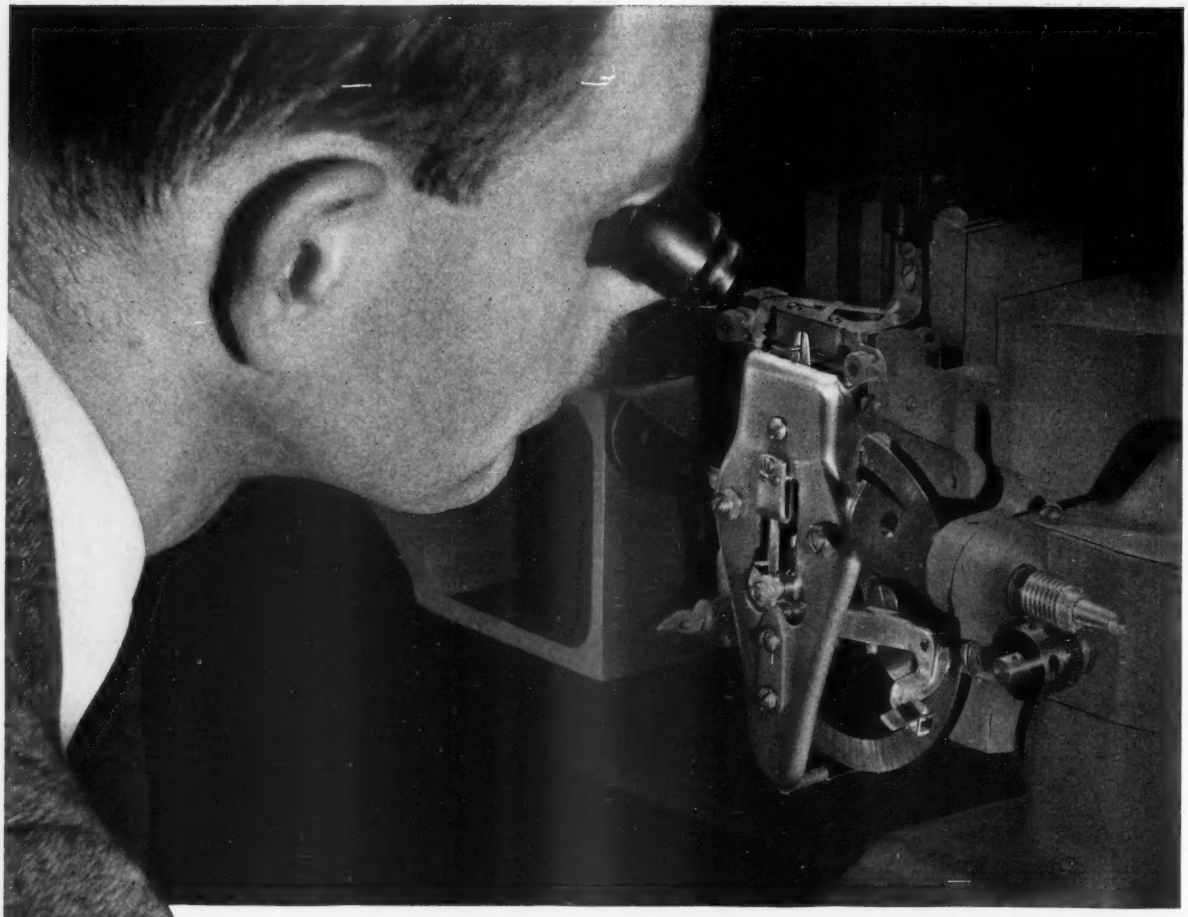


Fig. 9. Back shear table, for cutting concrete bars to length. ✦ ✦ ✦

Fig. 10. Bending concrete reinforcing bars. ✦



TO WATCH THE *Tiny Changes* THAT MICROMAX CAN FEEL

If you were measuring temperature with a manual potentiometer, you'd try to keep your eye on the galvanometer pointer . . . where Micromax automatically keeps its feelers. You'd try to catch changes at the very start . . . as Micromax actually does.

But, to do a Micromax quality job, you'd need a magnifying glass to see the first minute motions of the pointer. For Micromax sees them while they are still too small for the naked eye . . . and before they would interest any pyrometer but Micromax, it moves indicator, recording pen and (in automatic control) the control valve, feeder or damper.

There is no clearance through which the galvanometer pointer has to move before its motion is acted on. The pointer merely "leans" against the feelers and the effect is as though it leaned directly against index, pen and valve . . . all at once.

J-N33(21)

See Catalog N-33A

LEEDS & NORTHRUP COMPANY, 4974 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

Group Insurance In The Wire Industry

By Richard E. Brown, Publisher,
"Wire & Wire Products," New York, N. Y.

EMPLOYEE welfare programs occupy a prominent position in many companies that manufacture wire and steel rods. Among the features of such programs, designed to promote the security of employees, are thrift plans, credit unions, mutual benefit associations, and group insurance.

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THIS last-named aid to security ranks high in importance, company executives generally regarding it as an indispensable element of a well-regulated benefit program. For while other features have occasionally been discontinued, group protection continues undiminished. In fact, according to the Equitable Life Assurance Society of the United States, which introduced group insurance in 1911, the scope and volume of the protection has steadily increased, not only in the wire and rod industry but in all other fields throughout the country.

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FOR an understanding of the scope of group protection, a description of the various forms seems pertinent. All types are available to fifty or more employees of one employer and may be paid for entirely by the employer, in which event the insurance is called "non-contributory", or jointly by the employer and his employees, thus making the protection "contributory."

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GROUP life insurance, the first coverage introduced, is payable in the event of death from any cause. The amount of insurance for each employee is usually based on his earnings, normally being equivalent to at least a year's salary.

IN this way group life insurance serves, as do the other group coverages, to protect the pay envelope. Shortly after the introduction of this coverage the London Times aptly described it as "an American plan for giving a year's notice of the demise of the pay envelope."

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THE amount of protection for individual employees generally ranges upward from $1,000; in groups of several hundred employees this amount may reach or exceed $10,000, depending upon the aggregate insurance in the particular group. Under a contributory plan each employee normally pays 60 cents a month per $1,000 of insurance, the remainder of the low cost being paid by the employer.

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GROUP accident and health insurance provides weekly payments—usually ranging from $10 to $40, according to earnings—for disability resulting from non-occupational accident or sickness. Toward this protection, when it is on the contributory basis, employees generally contribute approximately 50 cents a month for each $10 weekly benefit, or from three-fifths to four-fifths of the gross cost.

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A THIRD coverage is group accidental death and dismemberment insurance. Issued in conjunction with or supplemental to either of the previously mentioned coverages, this provides a lump-sum payment in the event of the accidental loss of life, limb or eyesight. The normal cost of this insurance, when covering non-occupational accidents only, is 10 cents a month per $1,000 of insurance; for protection against both non-occupational and occupational accidents, the monthly cost is generally 15 cents.

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THE latest addition to the group family is group hospitalization insurance, which provides daily benefits—of $2 to $5—for hospital room and board, plus five times the daily benefit as reimbursement to the employee for charges for special hospital service. It also is available only in conjunction with group life or accident and health insurance. On the basis of a $3 daily benefit—the average amount provided—with a maximum of seventy days' hospitalization for any one disability, the gross cost is 50 cents a month per employee.

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PROVISION for old age is made available through group annuities, establishing a retirement income for employees, either independent of or supplemental to the old-age benefits of the Social Security Act. Since the passage of this Federal legislation many companies in various lines of business and industry have adopted supplemental retirement plans.

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AMONG the advantages of group protection to employees, aside from the low cost, is that medical examination is not required for any coverage, provided that the employee applies for insurance within a specified period. Also, in group life insurance there are no restrictions as to age, sex, or occupation; in group accident and health, accidental death and dismemberment, and hospitalization insurance—the three so-called supplemental coverages—the protection is available to an employee until age 70, but without other restrictions.

THE attitude of employees toward group insurance is illustrated by Equitable records which show that, while state insurance laws require that not less than 75 per cent shall be insured, in a large majority of cases more than 90 per cent have subscribed to a contributory plan, and in some instances fully 100 per cent participation has been registered.

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IN adopting group insurance plans employers have been influenced primarily by the need of employees for protection. This need is emphasized in studies showing that:

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FORTY-FOUR per cent of group insured employees have no other life insurance, and an additional 32 per cent have less than $1,000 of protection. One out of seven employees is disabled for more than one week each year, and the average period of disability is thirty-six days. Eighty-five per cent of this disability is caused by sickness and 15 per cent by accidents, with non-occupational accidents representing two-thirds of these. One out of every ten deaths among employees results from an accident, and more than two-thirds of such accidents are non-occupational. One person out of every fifteen receives hospital care each year, and many more need this care. In 1936, the latest year for which figures are available, the average period of hospitalization was thirteen days.

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HAVING adopted group life insurance and the supplemental coverages, employers have found that such action has eliminated the practice of "passing the hat" among employees, and made unnecessary any contributions by themselves, to aid the families of deceased employees or to assist employees themselves when they suffer illness or accident. These employers report that employees are thus freed from worry as to certain hazards, and that an unworried employee is a better employee.

THE earliest group insurance plan in the wire and rod industry was that of the American Rolling Mill Company, Middletown, Ohio, which, in addition to its extensive manufacture of steel and iron sheets and other products, including "Armco" ingot iron, produces wire and rods through a subsidiary, the Sheffield Steel Corporation. By adopting group life insurance in January, 1917, the American Rolling Mill Company was the first in the steel industry to provide this protection for its employees.

✦ ✦ ✦

THE attitude of the company is expressed by C. H. Murray, assistant to President Charles R. Hook, in a letter to the Equitable as follows:

✦ ✦ ✦

"Throughout this long period, we have seen group insurance thoroughly tested. In the beginning some regarded it as a 'frill', but today no industrial relations program is complete without it. It has been our experience that group insurance is one of the indispensable elements in building loyalty and cooperation. The knowledge that the company is providing protection for the employee's loved ones is a most important factor in creating a proper morale throughout the organization. It is well worth the cost.

"The confidence of our employees in what their group insurance will do is well justified by the facts. You have paid approximately $1,500,000 to dependents of deceased employees as death benefits, and in many cases this benefit was all the assets the family had with which to meet life's problems. We now have some 12,000 employees insured for more than $24,500,000 with you—an average of more than $2,000 per employee."

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THE second concern in the industry to adopt group protection is believed to have been Matthiessen and Hegeler Zinc Company, LaSalle, Ill., whose various zinc products include zinc wire. Inaugurating non-contributory — or "free"—group life insurance in May, 1917, the company thirteen years later placed the plan on a contributory basis in order to provide greater benefits, and at the same time supplemented this protestion with group accident and health insurance. Subsequently group accidental death and dismemberment insurance was added.

"Under the group life contract", writes Robert McClurkin, president of the company, "166 death benefits have been paid for an aggregate of $205,500, and in at least 48 instances the employee had no other protection for his dependents. Under the group accident and health policy there have been paid 124 accident benefits for $6,711 and 910 sickness benefits aggregating $52,100. Our employees like this coverage also, and we like knowing that they have the funds with which to obtain proper care when they are disabled.

"Our plan operates smoothly and efficiently. It is popular with our employees and with us. The facts tell the story."

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THE development of a group program to provide virtually complete protection, in response to the need of employees is well told by A. F. Metz, treasurer of the Okonite Company with factories at Passaic and Paterson, N. J., whose products include insulated wires and cables and super-tension and impregnated paper cables. Its group plan was initiated in January, 1918.

"We began, as did most of the earlier companies providing group insurance," writes Mr. Metz, "by adopting non-contributory group life, and since then we have responded to needs as they became apparent by adding other coverages. In 1926 we provided contributory life to make a greater measure of protection available to each employee, and in 1929 added group accident and health. This year we rounded out a complete Equitable protection program by adding group accidental death and dismemberment insurance on January 1 and, finally, group hospitalization on March 1.

"We are convinced that our employees need this comprehensive protection, and we are glad to make it available by sharing the moderate cost with them. Our group insurance plan is an integral part of a program to cooperate with and protect our employees and to increase the general welfare of the community. As such we consider it a most worthwhile investment."

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SIMILAR comments regarding a plan of four group coverages are made by S. E. Bramer, president of Copperweld Steel Company, manufacturing copper and bronze rods, wire, and strand at Glassport, Pa. Introducing group life and group accident and health insurance in March, 1931, the company added group accidental death and dismemberment and group hospitalization insurance last year.

"The administration of our group protection program," writes Mr. Bramer,

"gives us a chance to come in intimate touch with our personnel, and there is no question about the fine spirit fostered by our four-way insurance plan. Without hesitation, we recommend a comprehensive group program to any company seeking a more loyal and efficient organization."

✦ ✦ ✦

IN October, 1921 American Chain & Cable Company, Inc., whose general offices are in New York, adopted non-contributory group life insurance. Continuing this, the company a few years later introduced a contributory plan, and both types are still in force. Concerning the company's program, Assistant Secretary Frederick C. Geier writes:

"Group insurance was neither very well known nor in extensive use when we adopted the coverage. Its value was recognized in our organization immediately, however, and we are proud that our employees have had this protection for so many years.

"We appreciate what the death benefits—with total payments of more than $400,000—have done and our employees do, too. About 4,200 of them have the group life protection, and the company is happy to share the cost."

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A. Leschen & Sons Rope Company, St. Louis, makers of wire rope for eighty-one years, initiated non-contributory group life insurance in 1922 and supplemented this with contributory protection in 1930.

✦ ✦ ✦

"We consider this group insurance one of the finest contributions toward employee welfare work in our organization," is the comment of W. C. Henning, secretary and treasurer of the company.

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MANUFACTURING wire rope in Kenosha, Wis., the Macwhyte Company in March, 1923, gave to each employee a certificate of group life insurance.

✦ ✦ ✦

LATER this was supplemented by contributory protection and contributory group accidental death and dismemberment insurance was added.

"The Macwhyte Company," writes Vice-President R. B. Whyte," gets continued satisfaction from the knowledge that they have played a part in creating an estate for the families of our employees.

"Cooperation between the management and employees, and the mutual understanding of each other's problem, are most important factors in industry today. We feel that our group insurance plan has helped our employee relations very materially."

✦ ✦ ✦

IN 1926 group life insurance was made available to employees of National Electric Products Corporation, manufacturing conduits, wire, and cable, with general offices in Pittsburgh. Eight years later group accident and health insurance was added. The cost of both coverages is shared by the company and employees.

✦ ✦ ✦

PRESIDENT W. C. Robinson expresses his enthusiasm for group protection by writing:

"I do not believe we ever made a wiser move for the benefit of our employees or for the nurturing of loyalty and morale. We are gratified that our employees have had the advantage of this protection."

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A CONTRIBUTORY group life insurance program for a limited number of employees was adopted in October, 1935 by the Youngstown Sheet and Tube Company, Youngstown, Ohio, whose varied iron and steel products include wire rods, plain and barbed wire, and wire nails, staples, and hoops. After sixteen months' experience, the company extended protection to the entire organization.

✦ ✦ ✦

CONCERNING this experience President Frank Purnell writes as follows:

"More than 12,400 employees are now insured by the Equitable for from $1,000 to $5,000, depending upon their wage or salary classification. It was rather surprising for us to note that in two and one-half years 108 death benefits for an aggregate of $178,000 have been paid to dependents of deceased employees.

"Naturally, it is a source of great satisfaction to the company that this protection was available at a time when it was urgently needed by these dependents. As a guide to other companies which may be considering a group plan, we are pleased to say that our plan is a source of complete satisfaction to our employees and to us."

✦ ✦ ✦

THE Rome Cable Corporation, Rome, N. Y., whose product includes bare and insulated copper wire and cable, has been much impressed, according to Assistant Treasurer V. W. Collins, by the advantages of triple-group protection —group life, accident and health, and accidental death and dismemberment insurance — adopted in September, 1937.

"The interest shown when this group insurance was offered to our employees has not diminished," Mr. Collins writes, "but on the contrary has been strengthened as the many benefits have actually been experienced. We are pleased to report that the high percentage of 97 per cent who accepted the offer originally has been maintained with new employees added since that time."

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AMONG other organizations in the industry which have provided one or more forms of group protection for varying periods are:

General Cable Corporation, New York, manufacturing wire and cable and cable accessories; contributory group life and group accident and health insurance. The first-named coverage was adopted in 1920.

Anaconda Wire and Cable Company, New York, manufacturing several kinds of wire and cable. Equitable group life insurance, on the non-contributory basis, originating in a plant at Sycamore, Ill. in February, 1928, was successively extended to employees in plants at Marion, Ind.; Hastings-on-Hudson, N. Y.; Pawtucket, R. I., and Orange, Cal. Supplemental contributory protection was introduced two months later and subsequently extended to the other plants.

Colorado Fuel and Iron Corporation, Denver, which, in addition to the mining of coal and iron, includes wire and rods among its varied iron and steel products. Contributory group life insurance originated in this organization in July, 1928.

Phelps Dodge Copper Products Corporation, New York, whose products include copper rods and various kinds of wire in copper and other metals. Group life insurance originated in this organization in 1929, and group accident and health insurance was added in 1934. Both are on the contributory basis.

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IN the twenty-seven years of its existence group insurance has grown tremendously through the active cooperation and increasing interest of management in business and industry. In 1937 an increase of $1,525,000,000 of group life insurance—which serves as a measuring-rod for other group coverages—was registered, to bring the aggregate amount of this protection to approximately $13,650,000,000, covering nearly 8,800,000 employees in 23,600 employing companies. Indications are that group insurance in all its forms is headed for an even wider sphere of usefulness in coming years.

Evolution of Varnished-Cambric Cable--- Standard Added To Wire And Cable Series

By W. C. Hayman,*

Cable Engineering Department,
General Electric Company, Schenectady, N. Y.

Different processes in preparing lead-covered and braid-covered power cable and varnished cloth for insulation. ✦ ✦ ✦ ✦

THE recent approval of specifications for varnished-cambric insulated cables by the American Standards Association officially recognizes a product of which the 1937 United States production value totalled approximately $6,000,000. In its forty years of growth, varnished-cambric insulation has become an important part of the cable business.

STANDARDS HELP BUYERS PREPARE WIRE AND CABLE SPECIFICATIONS

The new standard specifications for varnished cloth insulation for lead-covered or braid-covered power cable is one of a group of standards for insulated wire and cable for general use. Taken together the entire series of standards gives industry nationally approved fundamental technical requirements for wires and cables. In preparing purchase specifications engineers will find it easy to refer to the appropriate American Standard for the wire and cable they are buying, but can specify individual preferences in make-up, special features, guarantees, payment for test samples, shipping details, and other commercial matters.

The standard for cloth insulation includes specifications for the materials used, including tensile strength, dielectric strength, and the effect of heat on the material; workmanship in preparing the cable and applying the insulation; properties of the insulation, which include thickness for various uses of cable; electrical properties; and test methods. Four tables show the recommended thicknesses of the insulation for different voltage, size, and type of cable.

Copies of the American Tentative Standard Specifications for Varnished Cloth Insulation for Lead-Covered or Braid-Covered Power Cable (C8.13-1937) are available from the American Standards Association at 40 cents each.

*Member of Technical Committee No. 6 on Varnished Cloth Insulation, Sectional Committee on Insulated Wire and Cable, American Standards Association.

THESE specifications as approved by the ASA are intended to apply to all sizes and classes of varnished-cambric insulated, lead-covered or braided cables which are to be used for the transmission and distribution of electrical energy. They may apply to underground, aerial, or indoor power cable under normal conditions of installation, and operating at voltages not above 17,000 volts between conductors for non-shielded multiple conductor cables. The specifications may further apply for single-conductor and shielded cables operating on an ungrounded neutral system not over 17,000 volts between phases, for single-conductor and shielded cables operating on a grounded neutral system not over 28,000 volts between phases, and at a conductor temperature not to exceed 75-degrees centigrade.

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THE history of the development of this type of cable reaches back to 1899. At that time William L. R. Emmet, of the General Electric Company, applied for a patent which constituted the ground work for later developments. This patent covered cable insulated by successive layers of tape wound around a conductor and coated with varnish. The varnish was allowed to harden and oxidize after the application of each layer. Probably—though it is not definitely known—no cable of this sort was manufactured commercially, as it would have been exceedingly stiff and hard to handle.

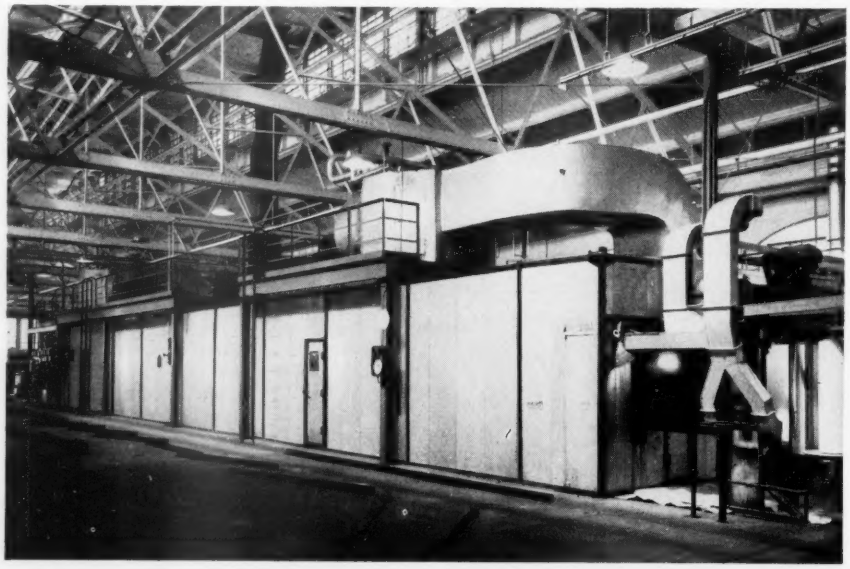

Fig. 1. Machine for impregnating cloth with varnish. ✦ ✦ ✦ ✦ ✦

Fig. 2. Roll of varnished cloth for insulated cable being slit into tapes.

IT was in 1901 that Emmet, this time in collaboration with Wallace S. Clark, applied for a patent covering an improvement on the original cable. This involved pretreating the cotton tapes with varnish, then applying the tape to the conductor in layers. After each layer the cable was run through a bath containing viscous, non-hardening insulating compound. This was the forerunner of modern varnished-cambric insulated cables; a variation of it was first manufactured commercially in 1902.

✦ ✦ ✦

IT was evident almost from the beginning that there would be wide application for the new cable. In the first place, high-voltage rubber insulation had been giving considerable trouble because of ozone cutting and difficulties encountered in keeping the conductor central within the insulation. Further, the cost of rubber suitable for high-voltage insulation was extremely variable, fluctuating between $1.00 and $3.00 per pound. Varnished-cambric insulation was less expensive.

✦ ✦ ✦

ONE of the several earlier uses of the new insulation was for apparatus leads. In this application the conductor was a flexible strand, insulated with varnished-cambric and covered with a braid. Another earlier application was for bore-hole, shaft, and tunnel use in mines; later, for vertical riser cables in tall buildings.

✦ ✦ ✦

PAPER insulation had also made headway in those early days, but its progress was slowed because of the skill required in installing and jointing. At that time there were many small utilities and industrial plants not having the trained personnel to handle paper-insulated cables. In addition, varnished-cambric insulation was not as susceptible to moisture as paper, and it could be bent at a shorter radius.

✦ ✦ ✦

VARNISHED-CAMBRIC had these advantages over paper insulation, and even took the limelight from the old standby, rubber, in that the "split" type of insulation could be used. Part of the insulation could be put on each single conductor and part applied as an overall belt as in paper insulations. The resulting cable was much smaller in diameter than if rubber had been used. Also, the insulation would withstand a higher temperature than would rubber.

✦ ✦ ✦

UNTIL about 1909 yellow varnished cloth was used, the varnish having a linseed-oil base. At that time, H. W. Fisher of the Standard Underground Cable Company, developed an apparatus suitable for measuring dielectric losses, and tests were made on yellow varnished cloth in sheets. These tests showed that the linseed-oil varnish had very high dielectric loss characteristics. This discovery led to the development of the asphaltic-base black varnished cloth, which has a loss of only from one-half to one-third of that of the linseed-oil base varnished cloth.

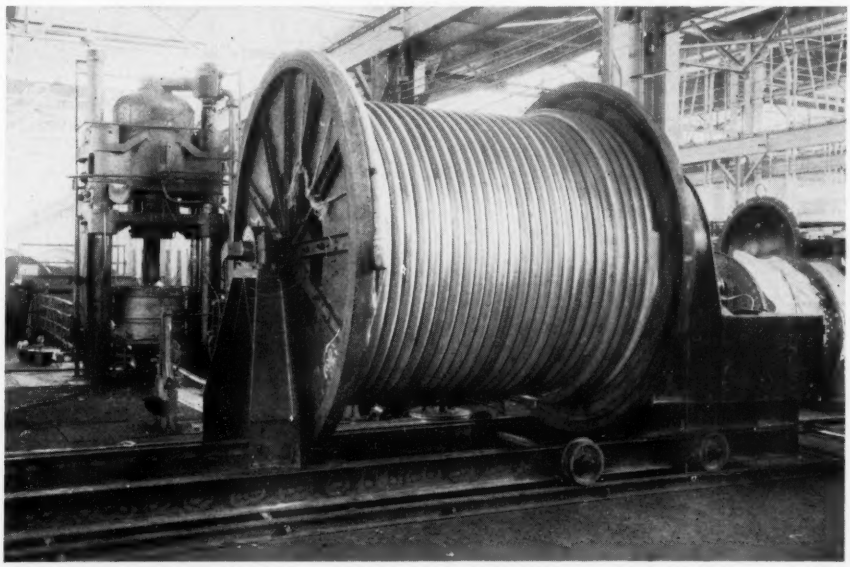

Fig. 3. Application of lead sheath for lead-covered cable. Leaded cable being wound on reel.

Varnish Baked

THIS modern insulation consists of a cotton cloth which is run through a bath of varnish and baked in an oven. Two or three separate coats are applied, depending on the thickness of the finished material. Each coat of varnish is baked before the next coat is applied.

✦ ✦ ✦

THE cloth generally comes in widths of 36 to 40 inches, and after being varnished it is slit into the widths required for winding on the cable through use of automatic taping machines. Insulating compound is applied between alternate layers of tape.

✦ ✦ ✦

SINCE 1931, efforts of engineers have often pointed toward raising resistance to high temperatures and corrosive atmospheres without sacrifice of dielectric strength, and substantial progress has been made. The field has been attractive to engineers because a solution of the problem has meant an appreciable increase in the current rating of varnished-cloth insulated cables.

✦ ✦ ✦

STEADY improvement, from a crude beginning to a practical, satisfactory present construction, has marked the 40-year course of this type of cable.

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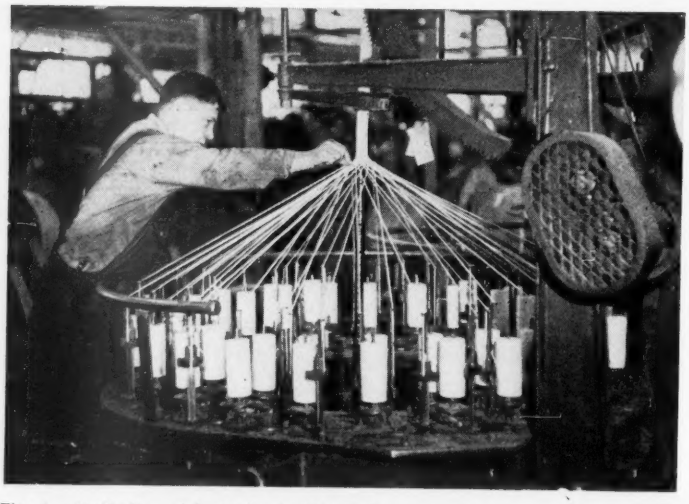

Fig. 4. Application of braid for braided cable. ✦ ✦ ✦

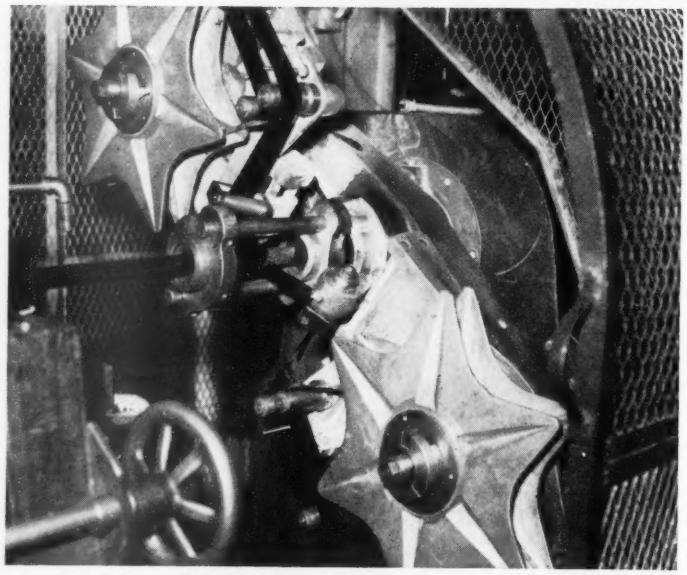

Fig. 5. Taping head for wrapping varnished-cloth tapes on cable. Tape can be seen in center of picture. ✦ ✦ ✦ ✦ ✦

A Series of Three Lectures Outlining the Fundamental Principles of Wire Mill Metallurgy Will Be Presented at the 1938 Wire Association Meeting at Detroit

THESE lectures will be in simple language, understandable by the non-metallurgist and will be presented as a part of the program of the Wire Association Meeting at Detroit, Michigan, October 17 to 21st inclusive.

By B. L. McCarthy,
Chief Metallurgist,
Wickwire Spencer Steel Co.,
Buffalo, N. Y.

Tentative titles are:
Part I — Principles of Metallurgy
Part II — Thermal Reactions
Part III — Metallurgy of Steel Wire

MEMBERS of the Wire Association will be entitled to attend these lectures without additional cost other than the regular registration fee for the meeting.

Wire Rope At Low Temperatures

By Anton Pomp and Alfred Krisch*

HOISTING and telpherage cables are exposed to considerable variation in temperature during the course of a year. In mountainous country particularly, temperature changes are often very abrupt, and readings as low as 60 below zero may be recorded. Little is known about the properties of rope wire at these low temperatures and the authors have therefore investigated 20 types of wire to determine tensile strength, elongation, reduction of area, resistance to bending, and torsion strength in the range 70 above to 60 below zero Fahrenheit. Twelve of these were patented wires with carbon varying between 0.41 and 0.77%. Tensile strength ranged from 190,000 to 250,000 psi. at room temperature, and diameter of wire from 0.079 to 0.158 in. Three were low carbon steels with 85,000 to 91,500 psi. tensile strength, and the remaining eight wires were 0.56% carbon steel tested at various stages of drawing.

✦ ✦ ✦

A 3-TON universal testing machine was used with a special attachment for the low temperature tests, which utilized a mixture of alcohol and carbon dioxide snow as the cooling medium in an inner container, with a circulation of air between it and the outer jacket. The test piece and specimen holder were completely immersed in the bath. The cooling medium was kept in constant circulation by evolution of carbon dioxide, so that accurate temperature readings could be taken from the bath rather than from the test piece itself.

ALL tests were made on bars 6.7 in. (170 mm.) between specimen holders. In the torsion test, results were calculated to a length 100 times the diameter of the wire, in a formula which gave comparable results in the bend test on wires of different diameters.

✦ ✦ ✦

TENSILE strength of all the wires tested increased uniformly as the temperature was lowered, averaging 3 to 4% higher at —20° C. (—4°F.) and about 6% higher at —50° C. (—60° F.). No relationship was found between carbon content and tensile strength, but tests of the same wire at different percentages of reduction showed a slightly lower increase in tensile strength with the larger number of passes. The effect of the lower temperatures on elongation and reduction of area was almost negligible.

✦ ✦ ✦

BEND and torsion properties, on the other hand, were far less uniform and seemed to be affected to a greater extent by variations in composition and properties of the wire. They were generally lower at the lower temperatures, and many tests gave minimum values at —20° C. (—4° F.), a temperature frequently encountered in Europe. The wires with 0.03% carbon showed a slight increase in torsion strength at —50° C. (—60° F.), but with higher carbon the torsion strength was generally lower at —50° C. than at room temperature.

EFFECT of drawing was erratic. Torsion strength decreased considerably at —20° and —50° C. after the first three passes but remained constant at all temperatures after the fourth pass. After the fifth pass the wires showed maximum torsion strength at —20° C. (—4° F.). Only about 20% of the wires investigated showed any substantial lowering in bend and torsion properties, the detrimental effect being very slight for the others.

✦ ✦ ✦

FROM these results the authors conclude that if additional stress is induced in wire rope by cooling to low temperature, with consequent contraction, it is compensated for to a certain degree by the increased tensile strength at low temperatures. A wire stretched tightly between two points contracts about 0.07% when cooled from +20 to —50° C. with a consequent increase in load of about 21,300 psi. This added load, however, induces in the wires investigated a proportionately somewhat smaller increase in tensile strength (about 6%), so that the factor of safety is lowered in spite of the higher tensile strength. In a stressed slack rope, the relationship is still unfavorable and it must be taken into consideration in calculating stresses for almost all wires at low temperatures.

✦ ✦ ✦

LOW temperature bend and torsion tests are not considered necessary for all wire which is to be woven into rope, but are recommended for applications which are likely to involve these types of stress.

*Abstract from Mitteilungen Kaiser-Wilhelm-Institut für Eisenforschung, Vol. XIX, p. 97, 1937.

Worm Driven Take Ups Used In Continuous Patenting, Tinning and Galvanizing of Round Wire

By G. A. Broden,
President, The Broden Construction Co., Cleveland, O.

THIS article deals only with the winding methods used in pulling the wires through the various processes necessary to produce the finish required. All of the Take Ups described are of the Worm Driven Type, which are far superior to any other means of driving the blocks and which will be described in detail as we go along.

✦ ✦ ✦

FIGURE #1 shows a 30 Block Worm Driven Frame for Patenting Rods and Wire for spring wire. This outfit of 30 Blocks, 15 on a side, is divided into two frames, each driven by a 20 H.P., D.C., 4 to 1 motor, giving speeds to the blocks of ¾ R.P.M. to 10 R.P.M.

✦ ✦ ✦

THIS large range of speed with a 4 to 1 motor is accomplished through a two speed Heli-Spur Gear Unit, one range of speed being ¾ to 3 R.P.M., and the other range 2½ to 10 R.P.M.

✦ ✦ ✦

THIS range of speed allows the frames to be used for rods or for wire, and as each frame has its own motor and gear reduction unit, rods can be run on one frame and wire on the other at the same time, and at their correct speeds.

✦ ✦ ✦

EACH pair of blocks has its own individual worm unit drive, and each unit is connected to the next one by flexible couplings. Individual worm units, self contained as these are, have the advantage that in case anything happens to one unit, it can be easily taken out and production resumed. These units are equipped with anti-friction bearings, and worm and gear running in oil means practically no maintenance, and the safety feature of enclosed gears is also worth mentioning.

✦ ✦ ✦

THESE frames can be made into any number of individual units and any number of blocks to suit conditions.

✦ ✦ ✦

FIGURE #2 shows a 14 Block Worm Driven Patenting Frame using an A.C. constant speed motor and an enclosed Variable Speed Reeves Transmission to give the desired range of speeds.

✦ ✦ ✦

Tinning

FIGURE #3 shows an Eight Block Worm Driven Fine Wire Tinning Frame. Each block has its own individual worm unit, which is easily removed if anything goes wrong and frame started up.

✦ ✦ ✦

THE blocks are 8″ in diameter, and start and stop by means of a special friction clutch which allows the block to start gradually and prevents breaks in the wire. The frame is all welded steel construction. The drive is a 3 H.P., A.C., Link-Belt Motorized P.I.V. Unit.

✦ ✦ ✦

FIGURE #4 shows a 30 Block Fine Wire Tinning Frame, 15 blocks on each side.

✦ ✦ ✦

Galvanizing Wire Take Ups

FIGURE #5 shows an 18 Block Worm Driven Take Up Frame for Galvanizing Round Wire. These frames are made in sections

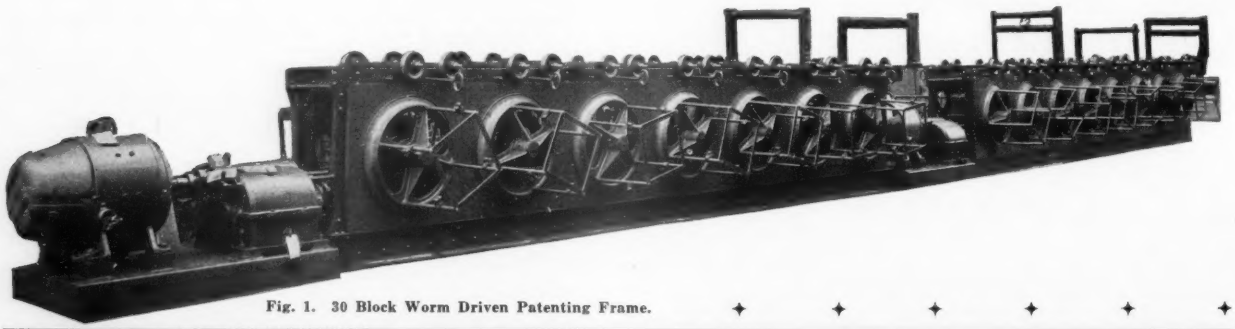

Fig. 1. 30 Block Worm Driven Patenting Frame. ✦ ✦ ✦ ✦ ✦ ✦

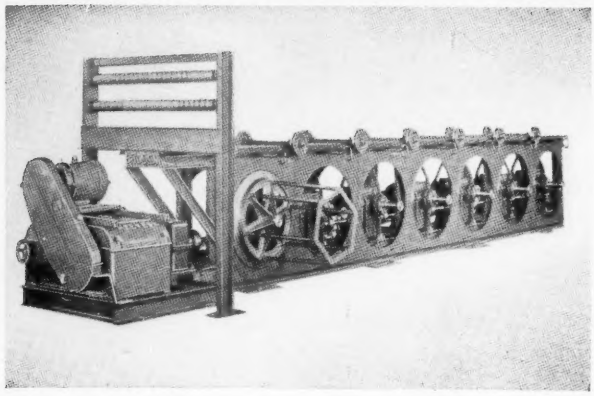

Fig. 2. 14 Block Patenting Frame.

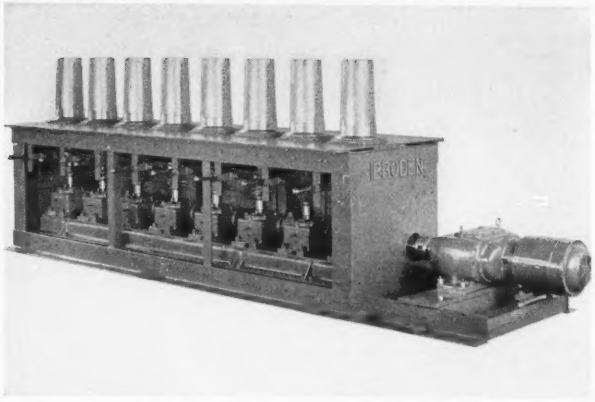

Fig. 3. 8 Block Worm Driven Fine Wire Tinning Frame.

of 12 or 18 blocks, each with its own individual motor and then incorporated into one frame as shown in Figure #1.

✦ ✦ ✦

THIS method of having the frame in small individual units allows different size wires to be run each at its own individual speed, with resultant gain in production over frames where all blocks are driven with one motor and different size wires run at the same time. The control of the ZINC on wire can also be maintained better for the different sizes.

✦ ✦ ✦

THESE frames are all worm driven, each two blocks have an individual worm unit of their own. These units can be made to give counterclockwise coils on both sides of the frame or clockwise on one side and counterclockwise on the other side.

✦ ✦ ✦

IN running wire through zinc or tin coating, there should be no chatter whatever, as this chatter would tend to show in the finished product. This is one of the biggest advantages of a worm driven frame in that the pull of the wire through the entire outfit is constant and uniform, and naturally reflects in better product.

✦ ✦ ✦

THESE frames can have any range of speed necessary for the different size wires. When D.C. current is available, Variable Speed Motors are used in connection with Heli-Spur Reduction Units as shown in Figure #5.

IN this way a wide range of speed on blocks can be obtained. Where A.C. current only is available, an A.C. motor in connection with a P.I.V. or Reeves Variable Speed Transmission can be used to accomplish the same thing.

✦ ✦ ✦

SUMMING up we find:

1) Advantage in using worms for drives means a more constant pull on material going through the Cleaning, Tinning and Zinc Baths, Wipers, etc., which means a better and smoother coating on the wire.

2) Breaking the frames up into two or three units means different size wire can be run on a frame at the same time, at proper speeds, with resultant increase in production and proper coating in each gage of wire.

3) Antifriction bearings and individual worm units running in oil means a big saving in maintenance.

4) The safety features of these designs have been highly developed.

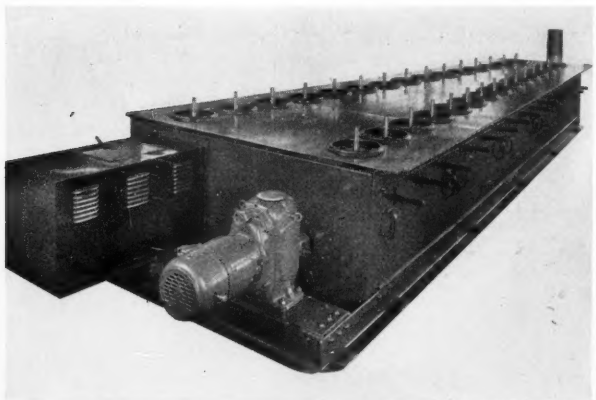

Fig. 4. 30 Block Fine Wire Tinning Frame. 15 Blocks on each side.

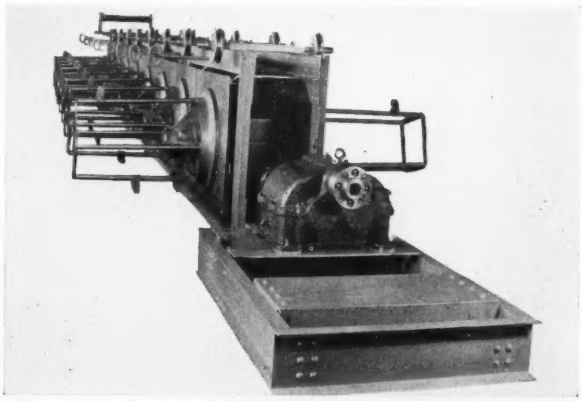

Fig. 5. 18 Block Worm Driven Takeup Frame for Galvanizing Round Wire.

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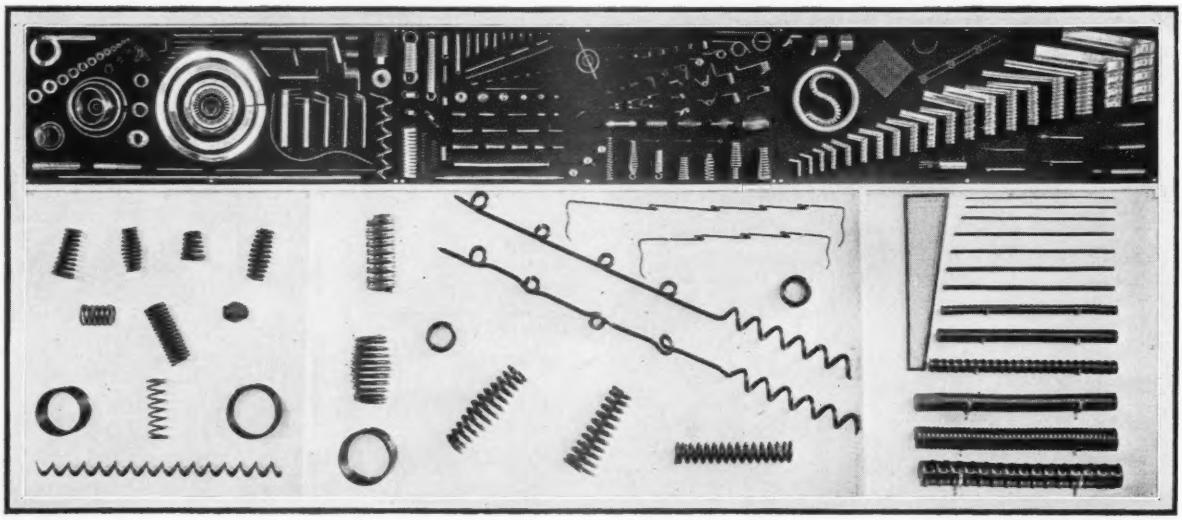

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Vol. 13 JUNE, 1938 No. 6

The Effect of Longitudinal Scratches On Valve Spring Wire*

PART II

By F. P. Zimmerli, W. P. Wood and G. D. Wilson†

ABSTRACT

The object of this study was two-fold: the development of a method for the measurement of depths and contours of surface scratches upon spring wire, and secondly, to determine the effects of scratches with varying depths and contours upon the endurance limit in torsion of a typical steel spring wire. ✦ ✦ ✦ ✦

Discussion of Results

THE values for endurance limit obtained in this study are presented in conjunction with photomicrographs of transverse sections of scratches or contour lines traced from such photomicrographs. The intended depth and the actual depth of each scratch are indicated; also the per cent decrease in endurance limit caused by the presence of the scratch. The purpose in presenting results in this form is to make it possible to readily compare the contour and depth of the scratch with the actual endurance limit obtained. From the standpoint of this work, the contour of the surface shown in Fig. 6 may be considered to be ideal. The endurance limit of a test specimen having such a surface may be used as a standard of comparison for the endurance limits of test specimens having scratched surfaces. The endurance limit of test specimens with a surface contour like the one shown in Fig. 6 is 110,000 pounds per square inch. In all cases the endurance limit has been determined to the nearest 5000 pounds per square inch. In this work the endurance limit is defined as that stress which will allow the sample to just withstand 10,000,000 oscillations. Any stress above this will cause failure before 10,000,000 stress cycles have been carried out.

✦ ✦ ✦

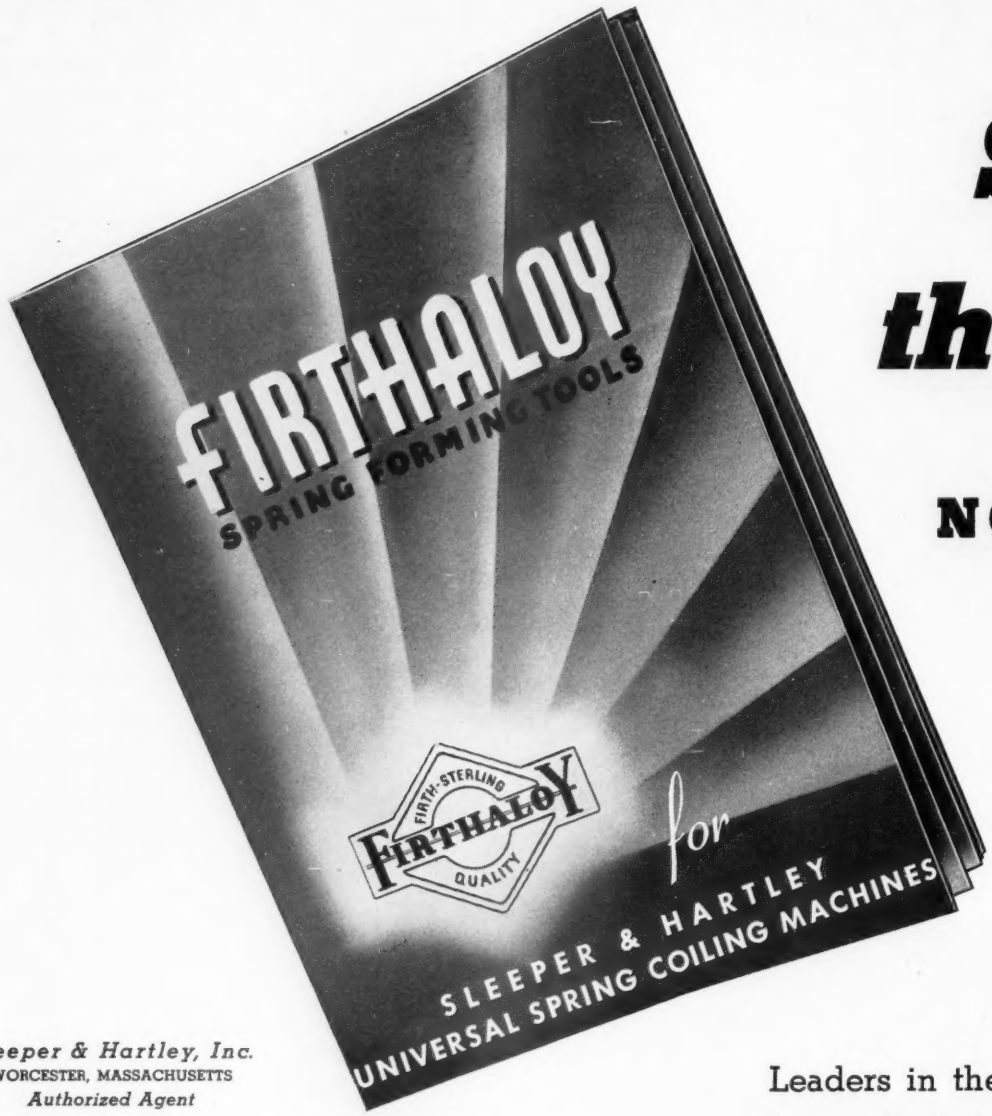
THE endurance limits of test specimens scratched with high speed steel tools are given in Figs. 7 to 19, inclusive. It will be noted that most of these scratches have a rather large radius of curvature at the bottom of the scratch. The shape of the scratch does not vary greatly with the angle of the tool. The point of the 15-degree tool wore down faster than the others, and hence, the scratches produced by this tool did not lower the endurance limit greatly. The 30-degree tool produced the sharpest scratches. For scratches over 0.002-inch deep the 45-degree tool did not make as sharp scratches as the 30-degree tool.

✦ ✦ ✦

IN all cases it will be noted that the endurance limit does not decrease in a constant manner as the depth of the scratch increases. This is due to the fact that as the depth of the scratch is increased, the point of the tool wears down to a greater extent and the sharpness of the scratch decreases. This is illustrated by several examples. In the case of the 30-degree tool the endurance limits for the 0.002-inch and the 0.005-inch scratches are the same. For the 45-degree tool the endurance limits for the 0.005-inch and 0.010-inch scratches are higher than that for the 0.002-inch scratch. In the case of the 15-degree tool the en-

*A paper presented at the Nineteenth Annual Convention of the American Society for Metals, Atlantic City, N. J., October 1937. Reprinted by permission of American Society for Metals.

†Of the authors, F. P. Zimmerli is Chief Engineer, Barnes-Gibson-Raymond Division of Associated Spring Corporation; William P. Wood is Professor of Metallurgical Engineering, University of Michigan; and G. D. Wilson is Metallurgist, Barnes-Gibson-Raymond Division of Associated Spring Corporation.



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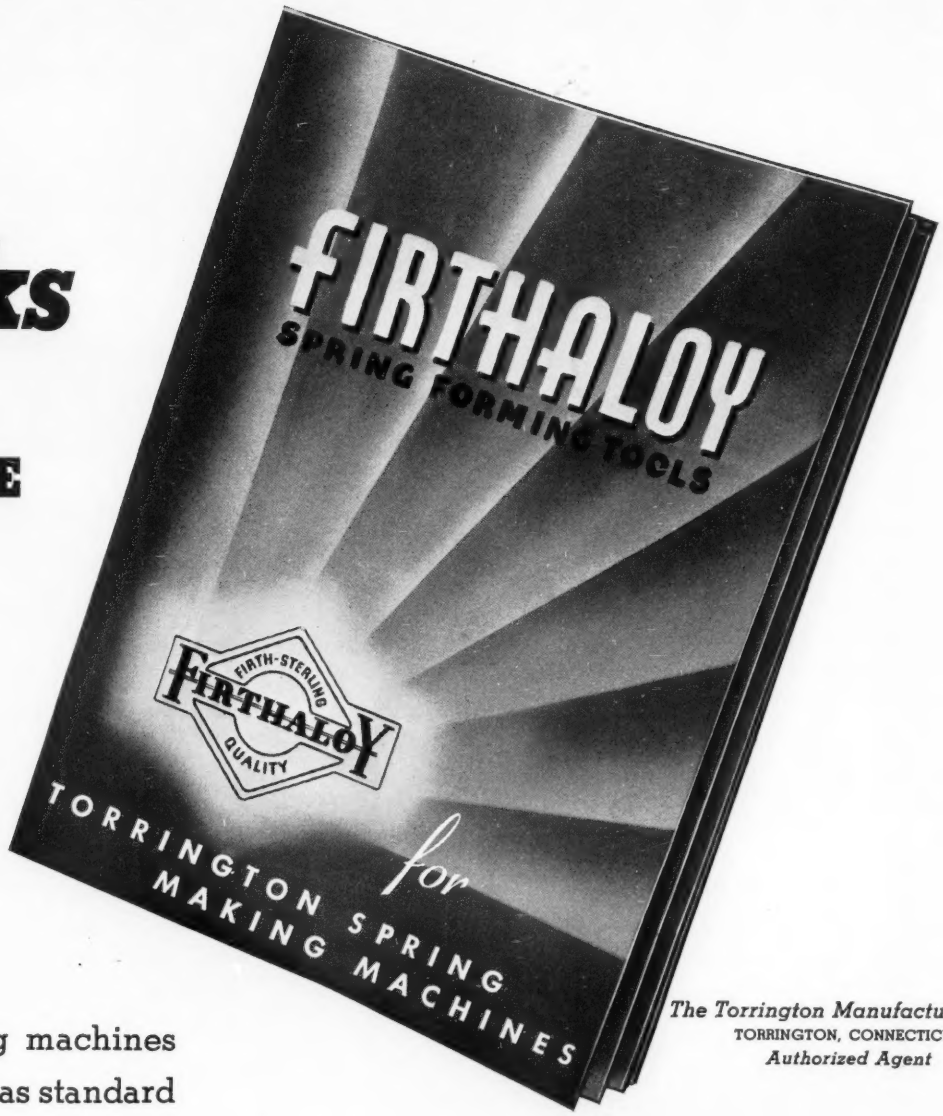

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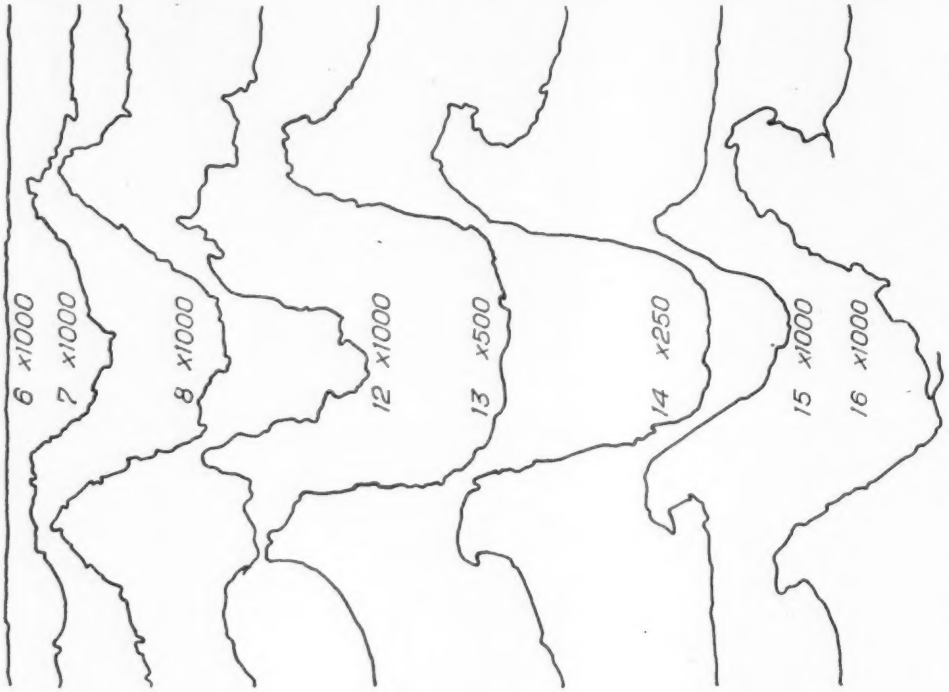
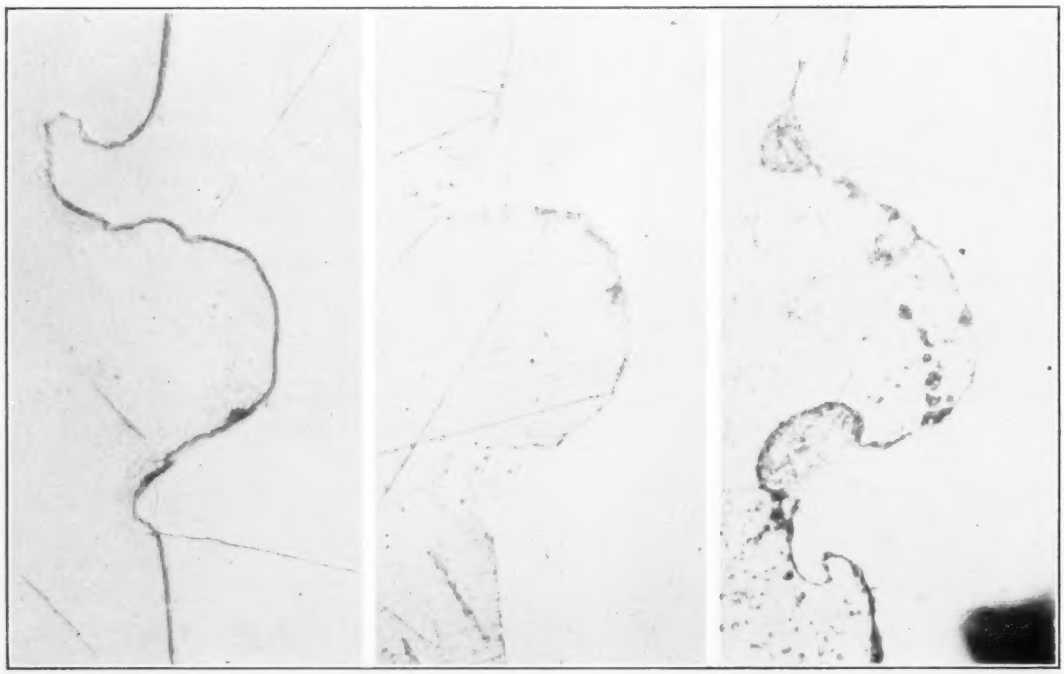
durance limits for the 0.001-inch and 0.002-inch scratches are the same. It will be noted that scratches made by this tool lowered the endurance limit less than any of the other scratches investigated. All of the 0.0005-inch scratches made with high speed tools failed to lower the endurance limit appreciably.

THE endurance limits of test specimens scratched with the Stellite tool are given in Figs. 20 to 23, inclusive. With the exception of the 0.0005-inch scratch, the results are somewhat similar to those obtained by use of high speed tools. For scratches over 0.001-inch deep the endurance limit is not decreased quite as much as is the case when high speed steel tools are used. This is probably due to the fact that the Stellite is more brittle than the high speed steel and the point crumbles away more rapidly in the deeper scratches. The 0.005-inch scratch made with the Stellite tool decreased the endurance limit by 5000 pounds per square inch. Ap-



Lines Traced from Photomicrographs of Specimens Scratched in Varying Ways. Magnification Indicated on Each Curve.

Fig. No.	How Scratched	Intended Depth Inch	Actual Depth Inch	Endurance Limit lbs. Per Square Inch	Per Cent Decrease in Endurance Limit
6	Polished	.....	.....	110,000	..
7	15° H.S. Tool	0.0005	0.00034	110,000	0.0
8	15° H.S. Tool	0.001	0.00056	105,000	4.5
12	30° H.S. Tool	0.001	0.00071	100,000	9.0
13	30° H.S. Tool	0.002	0.0015	90,000	18.1
14	30° H.S. Tool	0.005	0.0042	90,000	18.1
15	45° H.S. Tool	0.0005	0.0005	110,000	0.0
16	45° H.S. Tool	0.001	0.00056	100,000	9.0



Photomicrographs of Specimens Scratched in Varying Ways.

Fig. No.	How Scratched	Intended Depth Inch	Actual Depth Inch	Endurance Limit lbs. Per Square Inch	Per Cent Decrease in Endurance Limit
9 (upper)	15° H.S. Tool	0.002	0.0013	105,000	4.5
10 (center)	15° H.S. Tool	0.005	0.0033	100,000	9.0
11 (lower)	30° H.S. Tool	0.0005	0.00063	110,000	0.0

parently the greater hardness of Stellite leads to the formation of a sharper scratch at this depth.

✦ ✦ ✦

THE diamond tool scratches were apparently the sharpest of any of those investigated, since they decreased the endurance limit more than any other scratches of the same depth. They are shown in Figs, 24 to 26, inclusive. A scratch 0.0005-inch deep lowered the endurance limit to 95,000 pounds per square inch. Unfortunately, this depth was about the maximum that could be reached with the diamond tool without seriously damaging the point. This is apparent from the fact that the endurance limit of the 0.001-inch scratch is no lower than that for the 0.0005-inch scratch.

THE lowest endurance limit determined on scratched specimens was that of the specimens scratched with the 30-degree high speed steel tool to a depth of 0.005-inch. This endurance limit was 90,000 pounds per square inch. The actual depth of the scratch was 0.0042 inch. The smallest radius of curvature at the bottom of the scratch was approximately 0.0014 inch. The ratio of depth to radius of curvature is exactly 3. According to the work of Griffith, as given in his Table I, the factor by which stress in the outer fibre should be multiplied to get the stress concentration at the bottom of the scratch is between 2.54 and 2.66. If the average of these two factors, namely, 2.60, is used, the stress concentration produced by the scratch would be 234,000 pounds per square inch. This is quite plainly a ridiculous figure,

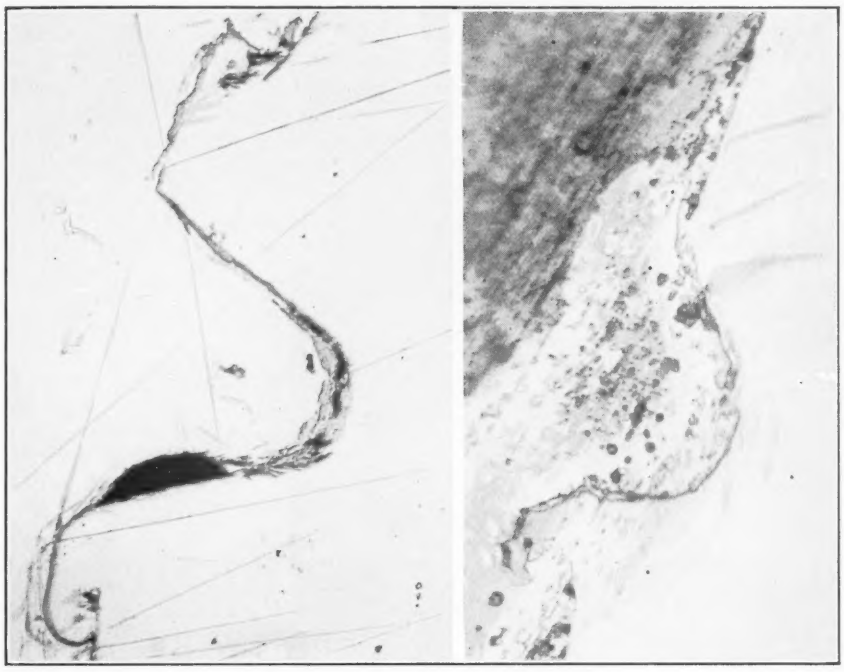
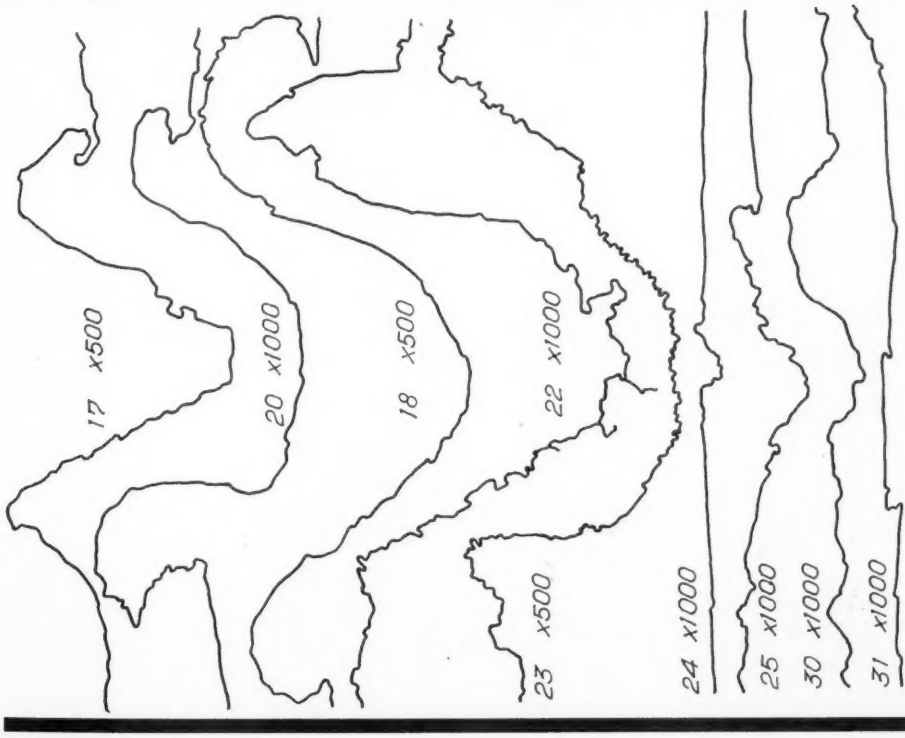


Fig. 19 (Upper). Photomicrograph of Specimen Showing Scratch Made by 45-Degree High Speed Tool. Intended Depth—0.10 Inch. Actual Depth—0.0042 Inch. Endurance Limit—95,000 Pounds Per Square Inch. Per Cent Decrease in Endurance Limit—13.6. ×250.

Fig. 21 (Lower). Photomicrograph of Specimen Showing Scratch Made by 30-Degree Stellite Tool. Intended Depth—0.001 Inch. Actual Depth—0.00063 Inch. Endurance Limit—100,000 Pounds Per Square Inch. Per Cent Decrease in Endurance Limit—9.0. ×1000.



Lines Traced from Photomicrographs of Specimens Scratched in Varying Ways. Magnification Indicated on Each Curve.

Fig. No.	How Scratched	Intended Depth Inch	Actual Depth Inch	Endurance Limit lbs. Per Square Inch	Per Cent Decrease in Endurance Limit
17	45° H.S. Tool	0.002	0.0015	90,000	18.1
20	30° Stellite Tool	0.0005	0.00056	105,000	4.5
18	45° H.S. Tool	0.005	0.0019	105,000	4.5
22	30° Stellite Tool	0.002	0.0014	95,000	13.6
23	30° Stellite Tool	0.005	0.0025	95,000	13.6
24	30° Diamond Tool	0.00025	0.00012	105,000	4.5
25	30° Diamond Tool	0.0005	0.00022	95,000	13.6

30—Surface of Etched Wire.
31—Surface of Commercial Spring Wire.

since it is much above the ultimate torsional strength of the steel. It appears, therefore, that no practical information can be obtained regarding the stress concentration in scratched wires by the use of his Table I.

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AS mentioned above, the lowest endurance limit obtained on a scratched test specimen was 90,000 pounds per square inch. The endurance limit of a polished test specimen was 110,000 pounds per square inch. Fatigue tests on helical springs made by F. P. Zimmerli indicated that the endurance limit of the wire was about 70,000 pounds per square inch. Figs. 27 and 28 are photomicrographs of a very poor quality spring wire which contains seams as well as scratches. It will be noted that none of the scratches were as sharp or as deep as some of those used upon test specimens in this investigation. It would appear, then, that the lower endurance limit of wire tested in the form of springs is not due entirely to the presence of surface scratches. The presence of hairline seams in wire would be more serious than surface scratches, since the stress concentration at the inner edge of the seam could be very high.

✦ ✦ ✦

PHOTOMICROGRAPHS were made of the surface of the defective spring wire after it had been acid etched. A typical one is shown in Fig. 29. A comparison of these photomicrographs with those taken before acid etching showed that the etch exaggerates or emphasizes the scratches. It also tends to roughen the surface of the wire, due to a preferential attack of the steel by the etching reagent in some places. Fig. 30 shows the effect of acid etching upon the surface of the wire. The surface before acid etching is shown in Fig. 31.

✦ ✦ ✦

Suggestions for Correlated Investigations

IT is evident that in the present investigation only the surface of the problem has been scratched, in more senses than one. The endurance limits of polished spring wire test specimens have been shown to be considerably higher than those of wire specimens which have not been machined or polished. It also has been shown that scratches made upon polished test specimens lower the endurance limit in repeated torsion appreciably. The decrease in endurance limit produced by the presence of scratches, however, did not fully account for the difference in endurance limits of polished specimens and commercial wire in the shape of helical springs. Some English investigators suggest that this discrepancy is due to surface decarburization and oxidation. In the present investigation there was no decarburization of the wire used, so the decreases in endurance limit could not be assigned to this cause.

✦ ✦ ✦

IT is evident that the contours of surface scratches are much more important in causing a decrease in endurance limit than are the depths of the scratches. The former have a profound effect upon stress concentration, while the latter do not affect it so much. Mechanical defects such as scratches produced during the drawing and coiling operations can never be as serious in causing spring failures as seams produced during the original processing of the wire material.

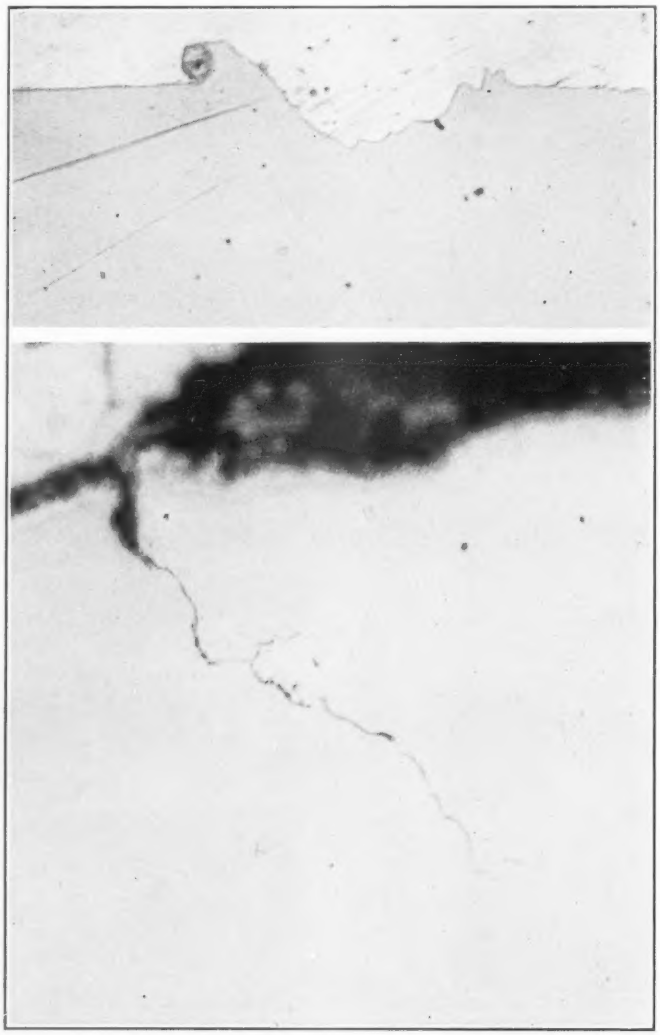

Fig. 26 (Upper). Photomicrograph of Specimen Showing Scratch Made by 30-Degree Diamond Tool, Intended Depth—0.001 Inch, Actual Depth—0.00039 Inch, Endurance Limit—95,000 Pounds Per Square Inch, Per Cent Decrease in Endurance Limit—13.6. ×1000.

Fig. 27 (Lower). Photomicrograph of Surface of Defective Wire, Depth of Defect —0.003 Inch. ×1000.

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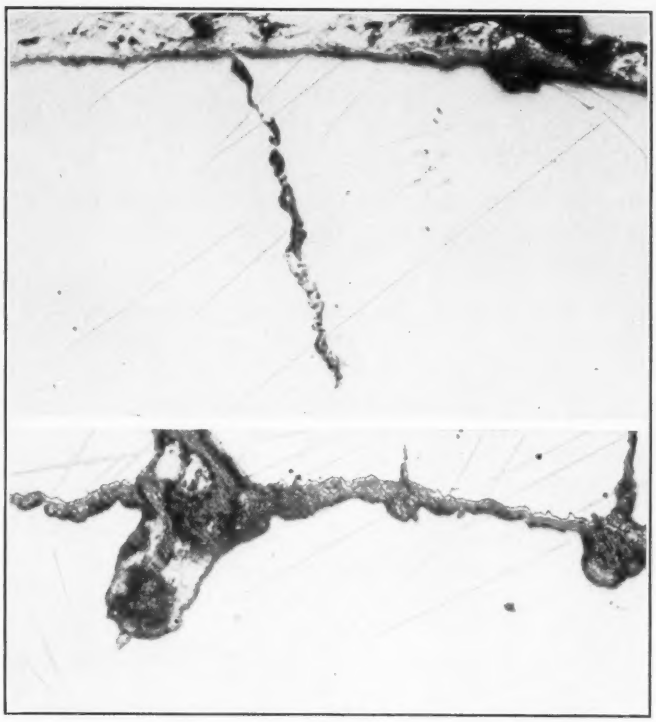


Fig. 28 (Upper). Photomicrograph of Surface of Defective Wire, Depth of Defect —0.008 Inch. ×250.

Fig. 29 (Lower). Photomicrograph of Surface of Etched Defective Wire, Depth of Defect—0.0043 Inch. ×250.

Make Your Plans Now To Attend
THE ANNUAL WIRE ASSOCIATION MEETING AND CONVENTION
To Be Held In Association With The
NATIONAL METAL CONGRESS
At DETROIT, MICH. OCTOBER 17th to 21st, 1938

New Type Wire Drawing Machines By Aetna-Standard Engineering Co., Youngstown, Ohio

A RECENT installation, the first of its kind, of new type wire drawing machines has made possible the manufacture of an improved spring wire by the Jones & Laughlin Steel Corporation.

✦ ✦ ✦

SPRING wire with a combination of high tensile strength, exceptional resistance to fatigue and uniformity to gage is now being produced on these new machines which incorporate the unusual feature of a water cooling system to control to best advantage the heat generated in the drawing process.

✦ ✦ ✦

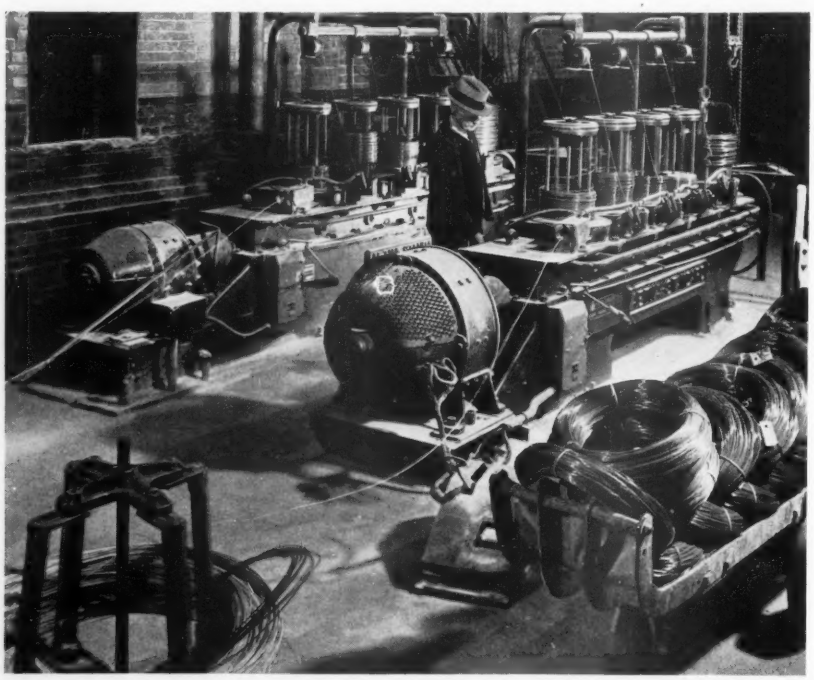
THIS control of temperatures generated in metal by cold working is becoming increasingly important in the attainment of exceptional physical properties and uniformity of size in spring wire. Since in these low temperature ranges the time element is more important than actual temperature, the artificial cooling of the wire during working serves to suppress the heat, but is designed primarily to curtail the duration of the critical heat.

✦ ✦ ✦

THE effectiveness of this cooling feature is demonstrated by the fact that on the finishing block, number 19 wire at 400 feet per minute is cooled so fast that no more than three or four wraps at the block fillet have any sensible warmth and intermediate blocks naturally run cooler.

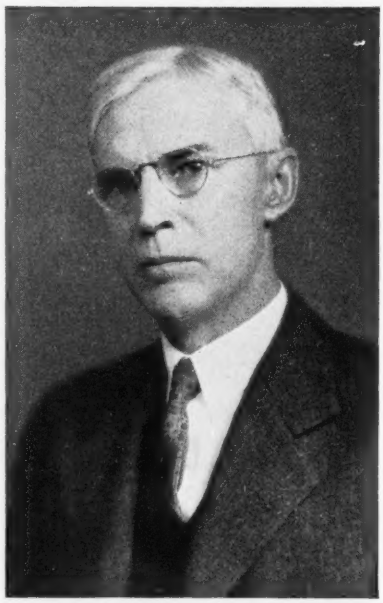
✦ ✦ ✦

THESE machines, manufactured by the Aetna-Standard Engineering Company, are of the general Connor type, except that the take-off of wire is overhead rather than through the block center, which makes for easier threading and simplifies transmission.



The first installation of its kind, these wire drawing machines, recently placed in operation by the Jones & Laughlin Steel Corporation, are producing an improved spring wire that has a combination of high tensile strength, exceptional resistance to fatigue, and uniformity to gage. One of the features of this machine is a highly effective water cooling system which makes possible control of heat generated in the drawing process. ✦ ✦ ✦ ✦ ✦ ✦ ✦

George D. Hartley Opens Office as Consultant



GEORGE D. HARTLEY

Born in British Isles in 1875. Educated at Montreal, Canada. Served for twelve years, generally as chief draftsman, in various posts, designing electrical machinery and equipment, textile machinery, steam engines, special and wire forming machinery, steam shovels, dredges, linotype machines, typecasting and composing machinery. For several years acted as assistant to Mr. P. T. Dodge, Pres., Mergenthaler Linotype Co. on inventions and patents. Organized with the late Frank H. Sleeper, in 1913, the firm of Sleeper & Hartley, of Worcester, Mass. Acted as Treas. and in charge of sales from the beginning, and from 1922 to 1935 as General Manager, owing to Mr. Sleeper's illness. Spent most of 1937 in Europe.

ANNOUNCEMENT is made by George D. Hartley, who retired about three years ago as vice president and general manager of Sleeper & Hartley, Inc., Worcester, Mass., that he has opened an office as consultant at 311 Main Street, Worcester, Mass.

✦ ✦ ✦

FOR many years Mr. Hartley has been actively identified with a wide range of industrial and mechanical work and since his retirement from Sleeper & Hartley has visited many European wire plants, investigating conditions in the leading countries of the world.

✦ ✦ ✦

MR. Hartley's experience should enable him to advise clients from a practical standpoint, and he is particularly prepared to take on any work concerned with

Investigations and Patents.
Experimental and development work.
Plant Surveys.

(*Please turn to Page 318*)

Exports and Imports of Wire

Exports of Iron and Steel Wire Products in March, 1938 and March, 1937
(In Gross Tons)

	MAR. 1938	FEB. 1938	MAR. 1937
Wire rods	5,377	783	3,057
Strip steel	5,005	7,036	8,552
Plain, black or galvanized iron or steel wire	2,560	2,749	6,179
Barbed wire and woven wire fencing	1,706	1,052	3,785
Woven wire screen cloth	80	113	119
Wire rope	446	218	648
Insulated iron or steel wire and cable—see analysis below			
Other wire and manufactures	451	483	702
Wire nails	1,408	1,145	2,653
Tacks	27	16	26
Other nails, including staples	245	146	411
Bolts, machine screws, nuts, rivets and washers	806	616	1,002
Total, these 11 classifications	18,111	14,357	27,134

Imports of Iron and Steel Wire Into the United States
(In Gross Tons)

Concrete reinforcement bars	23	263	1,183
Hollow bar and drill steel	92	103	255
Wire rods	369	588	1,631
Barbed wire	538	1,899	1,297
Round iron and steel wire	96	127	595
Telephone and telegraph wire	3	2	2
Flat wire and strip steel	247	337	332
Wire rope and strand	228	165	334
Other wire	82	111	410
Hoops and bands	724	1,263	2,586
Nails, tacks and staples	365	898	1,991
Bolts, nuts and rivets	13	9	92
Total, these 12 classifications	2,780	5,765	10,708

Exports of Insulated Wire and Cable, March, 1938

	Foreign		To U. S. Possessions	
	Pounds	Dollars	Pounds	Dollars
Weatherproof wire	399,013	$ 71,361	102,948	$17,357
Rubber-covered wire	642,435	137,424	111,592	23,139
Other insulated copper wire	420,859	149,353	157,945	26,535
Nickel-chrome electric resistance wire	27,323	31,107	.....	.....
Total, these 4 classifications	1,489,630	$389,245	372,485	$67,031

Ingots, Pig Iron and Black Steel Sheet Exports Heaviest

STEEL ingot exports had the highest tonnage of any semi-finished or finished iron and steel product shipped during March, the 23,021-ton total comparing with 29,497 tons in February and 4,082 tons in March, 1937. The prinicpal markets were Japan, 18,625 tons; Canada, 1,833 tons; and the United Kingdom, 1,690 tons. Pig iron ranked next with 22,519 tons against 54,332 tons and 14,435 tons, went mostly to Japan, 15,570 tons. Black steel sheets followed with 20,963 tons, aginst 19,986 tons and were taken chiefly by Australia, 3,819 tons; Canada, 3,570 tons; the United Kingdom, 3,417 tons; the Soviet Union, 2,846 tons; and Brazil, 1,878 tons.

Plate, Tin Plate, and Steel Bars Important

FOURTH-RANKING in the month's trade was tin plate totaling 15,201 tons compared with 15,063 tons and 23,484 tons and went to many markets the outstanding ones being Japan, 6,449 tons; the Netherlands, 1,094 tons; Canada, 1,027 tons; and British Malaya, 919 tons. Steel bars followed with 15,496 tons, aginst 10,493 tons and 10,221 tons, the chief outlets being Kwantung, 2,377 tons; Canada, 1,940 tons; Japan, 1,865 tons; British South Africa, 1,420 tons; and Hong Kong, 1,077 tons. The trade in structural shapes aggregated 10,119 tons, against 11,165 tons and 20,090 tons, and the principal markets were Canada, 2,334 tons; Venezuela, 1,181 tons; Chile, 966 tons; Kwantung, 691 tons; and British South Africa, 667 tons.

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Japan Leading Market in March

EXPORTS to Japan in March totaled 47,247 tons in comparison with 39,400 tons in February and 33,916 tons in March, 1937. The outstanding products in this trade were ingots, 18,625 tons; pig iron, 15,570 tons; tin plate, 6,449 tons; wire rods, 2,684 tons; and steel bars, 1,856 tons. Canada accounted for 21,295 tons, against 19,647 tons and 39,119 tons, of mostly black steel sheets, 3,570 tons; strip steel, 2,682 tons; shapes, 2,334 tons; plate, 2,110 tons; steel bars, 1,940 tons; ingots, 1,833 tons; and tin plate, 1,027 tons. Shipments to Kwantung totaled 10,253 tons, against 10,786 tons and 4,606 tons, and consisted chiefly of plate, 3,813 tons; steel bars, 2,377 tons; rails, 1,622 tons; and wire rods, 1,500 tons. Venezuela was fourth-ranking with 8,997 tons, against 8,290 tons and 6,948 tons, and the outstanding products were pipe, 5,428 tons, and shapes, 1,181 tons. The United Kingdom took 8,746 tons, against 40,130 tons and 804 tons, of chiefly black steel sheets, 3,417 tons; ingots, 1,690 tons; and strip steel, 1,160 tons. Australia's shortage of sheets was reflected in the March trade when out of that country's 8,498-ton aggregate black steel sheets (3,819 tons) and galvanized sheets (3,771 tons) accounted for practically the entire trade.

✦ ✦ ✦

Imports Decline to Very Low Point

IMPORTS of iron and steel products (excluding scrap) in March amounted to only 11,600 tons valued at $990,379 in comparison with 19,589 tons valued at $1,414,688 in the preceding month and 49,898 tons valued at $2,420,135 in the corresponding one of 1937.

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Shapes, Steel Pipe, and Steel Bars Leading March Imports

THE principal product imported in March on a tonnage basis was structural shapes totaling 2,123 tons compared with 2,072

(*Please turn to Page 308*)

Exports and Imports of Wire

(*Continued from Page 307*)

tons in February and 8,650 tons in March, 1937, and came chiefly from Belgium which furnished 1,727 tons. Next in importance was steel pipe with 1,348 tons, aginst 3,981 tons and 3,463 tons, and the outstanding supplying country was Germany which furnished 1,144 tons. Steel bars followed with 1,163 tons, against 1,666 tons and 6,596 tons, and in this trade Belgium (500 tons) and Germany (476 tons) accounted for the bulk. The trade in ferromanganese ranked fifth with 1,057 tons, against 634 tons and 4,108 tons, and came chiefly from Norway which furnished 917 tons.

✦ ✦ ✦

Belgium and Germany Outstanding Sources in March

BELGIUM furnished 4,492 tons of iron and steel products in March in comparison with 8,706 tons in the preceding month and 16,571 tons in March, 1937. The principal items in this trade were wire shapes, 1,727 tons; hoops and bands, 638 tons; and steel bars, 561 tons. Germany accounted for 2,369 tons, against 3,802 tons and 7,171 tons, and those items outstanding were pipe, 1,144 tons, and sheets, 476 tons. Sweden's share was 1,492 tons, against 1,190 tons and 3,214 tons, in a scattered trade in which steel bars totaling 414 tons and wire rods totaling 310 tons were the most important. Norway ranked fourth with 1,080 tons, against 519 tons and 5,718 tons, with ferromanganese totaling 917 tons accounting for the bulk of the trade. France followed with 821 tons, against 655 tons and 3,825 tons, with shapes, 298 tons; rails, 256 tons; and cast-iron pipe, 238 tons, outstanding.

✦ ✦ ✦

CARD CLOTHING imports totaled 19,301 square feet valued at $34,918 in comparison with 18,476 square feet valued at $33,234 and in the trade the United Kingdom (16,838 square feet valued at $30,257), and Belgium (1,234 square feet valued at $2,795) were outstanding.

✦ ✦ ✦

THE trade in WIRE HEDDLES amounted to 256,000 pieces against 909,000 pieces and Germany accounted for the entire trade.

✦ ✦ ✦

MARCH receipts of WIRE CLOTH AND SCREENING totaled 28,932 square feet against 48,201 square feet and the outstanding supplying countries were Canada (10,533 square feet), the Netherlands (9,510 square feet), and Germany (7,239 square feet).

✦ ✦ ✦

IMPORTS of WIRE FENCING AND NETTING galvanized before weaving, amounted to 575,250 square feet in comparison with no trade in February and came from Belgium. Of that galvanized after weaving, the total was 505,200 square feet against 782,500 square feet and the supplying countries were Belgium (130,200 square feet), Germany (270,000 square

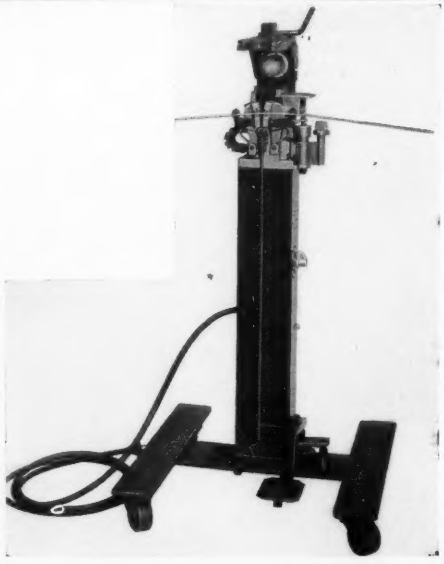
(*Please turn to Page 323*)

MICROMETER PRECISION MICRO-WELD TRADE MARK REG. U. S. PAT. OFF.

CONTINUOUS IMPROVEMENT

MICRO-WELDERS with dial indicating annealing attachments are now available for high carbon wire.

There is positive control of annealing temperature and already hundreds of these special MICRO-WELDERS are proving their dependability and satisfactory performance with leading manufacturers.



MICRO PRODUCTS COMPANY
20 NORTH WACKER DRIVE, CHICAGO, ILL.
Telephone State 7468

'Round the World With the Wire Industry

Production of Rolled Wire In Germany

ROLLED wire production in Germany since 1933 has followed an uninterrupted upward curve, although the output in 1937 registered a relatively smaller gain than during the 4 preceding years, advises the American Consulate, Cologne. Production in 1937 totaled 1,208,032 metric tons, 1,142,016 in 1936, 1,027,647 in 1935, 786,123 in 1934 and 673,980 tons in 1933. Exports in 1937 totaled 59,430 tons (imports 6,303 tons), 37,674 in 1936 (5,886 tons), 42,526 in 1935 (20,886 tons), 39,287 in 1934 (107,189), and in 1933, 44,608 tons (96,420 tons). It will be noted that while imports have recorded a steady decline, a considerable expansion has been made in exports. It is stated that while the 1937 rolled wire output established a new record, existing facilities permit a still higher output provided there is a sufficient supply of raw material and "efficient labor".

✦ ✦ ✦

German Notes

EXPORT sales of wire and wire products totaled approximately 12,000 tons which is 17% less than the same period last year. The general business situation in the wire machinery field is most satisfactory. A large influx of business has been brought to the German industry by the Leipzig Spring Fair. The export business is better to the European markets than to the Overseas. National Spain, Portugal, Great Britain, Belgium and Italy are among the recent purchasers. The best Overseas customers were Japan and Australia. Shipment dates to domestic customers vary between 6 and 9 months and for export between 4 and 5 months. Business in wire drawing, wire ropes, stranding, and wire netting machinery was better than in wire nail and barbed wire machinery. Prices for all wire machinery have been unaltered for a year.

✦ ✦ ✦

IWECO Price Situation

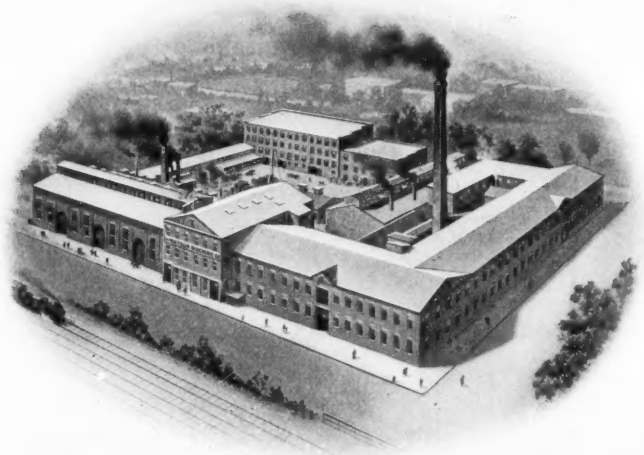
THE IWECO has been forced to reduce export prices to certain markets in Latin America, among which are Chile and Brazil, from 8 to 10% for all wire and wire products. Merchants in these markets have the authority to accept lower prices if American prices should still be lower. It will be remembered that a gentleman's agreement had been signed by the American wire industry and the IWECO concerning Brazil and some other markets, which agreement has been well maintained by the few large American wire makers, who entered into this agreement with the IWECO. It appears, however, that some of the smaller American manufacturers made arrangements with some ex-

(*Please turn to Page 310*)

THE WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON, NEW JERSEY, U. S. A.



ENGINEERS MACHINISTS

MANUFACTURERS OF

ELECTRICAL WIRE & CABLE, WIRE ROPE, CORDAGE & GENERAL MACHINERY

YOUR INQUIRIES ARE INVITED

'Round the World with the Wire Industry

(*Continued from Page 309*)

porters, establishing their own agencies in Brazil and Chile, which led to cutting prices. The quantities sold in this way in Latin America (chiefly barbed wire and fencing wire) are not very large, but enough to disturb the business. The general demand for wire products in the African markets has improved, but elsewhere is quiet. The European outside competition is confined to small business, not exceeding 3 to 4% of the IWECO turnovers. It will not be difficult for the IWECO to extend the cartel agreements and extension negotiations will soon begin. At present no change of prices for wire products is in effect.

✦ ✦ ✦

German Wire Mesh Production

THE production of brass wire mesh is nearly at an end in Germany, except for export purposes. Only about 3,000 rolls of brass mesh were produced in February, 1938 for domestic consumption, which is 60% of last year's production and only 8% of 1936. A similar decline of production is noticed in phosphor bronze wire mesh, although production of copper wire mesh did not decline. Aluminum alloy mesh has taken the place of the above-named products. Aluminum wire mesh also shows a sharp gain on the export market—42% over 1936 when exports were then 35% better than in 1935; whereas total exports of brass, copper and phosphor bronze wire declined 11% in 1937.

✦ ✦ ✦

Production of Wire Products In U. S. in 1937

IN 1937 the production of wire bars at 3,009,290 tons was barely ahead of the 1936 output of 2,997,888 tons, and was well below that in 1929, when 3,134,409 tons were produced.

✦ ✦ ✦

PRODUCTION of drawn wire, as will be seen from the tables below, declined some 74,000 tons; that of barbed wire over 7,000 tons; but there was an increase of about 19,000 tons in woven wire fence production.

✦ ✦ ✦

PRODUCTION of wire nails declined about 47,000 tons and cement-coated nails slightly. However, the striking feature in these figures is the contrast with the years 1928, 1929 in the table below.

✦ ✦ ✦

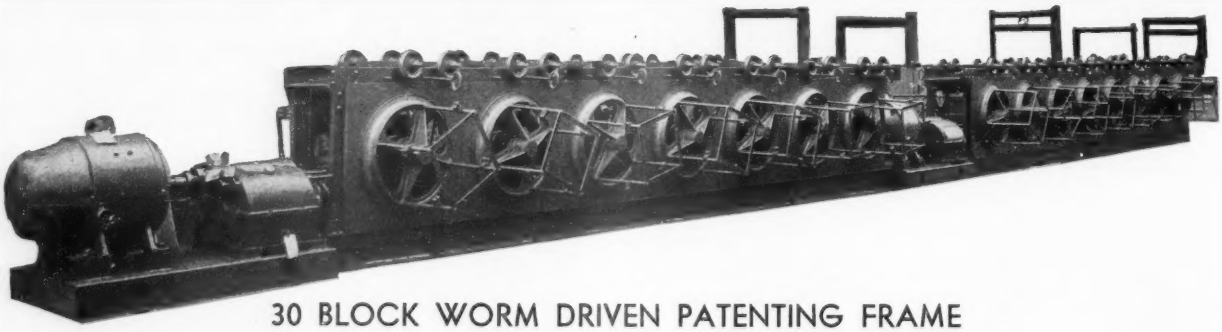
PRODUCTION of wire rods:

	Gross tons		Gross tons
1928	3,080,816	1933	2,024,095
1929	3,134,409	1934	1,723,765
1930	2,348,600	1935	2,440,794
1931	1,844,620	1936	2,997,880
1932	1,186,181	1937	3,009,290

✦ ✦ ✦

PRODUCTION of drawn wire, barbed wire, woven fence and bale ties:

	Drawn	Barbed	Woven fence
1932	901,883	76,923	96,843
1933	1,464,032	142,533	149,489
1934	1,369,233	137,024	127,804
1935	1,944,479	169,635	200,076
1936	2,401,195	171,380	206,688
1937	2,327,705	164,221	225,362



30 BLOCK WORM DRIVEN PATENTING FRAME

This outfit consists of two frames, each driven by a 20 H. P., D. C., 4 to 1 motor, through a two speed Heli-Spur Gear Reduction Unit, giving a range of speed to blocks of 3/4 to 10 R. P. M.

This range of speed allows for Patenting of Rods or Wire.

Each pair of blocks, which are 30" diameter, has its own individual self contained worm unit connected to the next one by flexible couplings.

Frame runs quiet, maintenance is low, and pull is uniform.

BRODEN CONSTRUCTION CO.

ENGINEERS - - BUILDERS

Wire Mill and Cold Rolling Equipment

11730 Harvard Avenue CLEVELAND

BALE tie output in 1937 was 49,755 tons against 52,683 tons in 1936.

✦ ✦ ✦

PRODUCTION of nails:

	Wire	Cement coated wire *
1928	635,450	94,772
1929	584,868	94,587
1930	426,849	67,327
1931	338,507	49,320
1932	240,811	33,063
1933	398,513	51,495
1934	276,634	37,255
1935	396,068	46,697
1936	532,142	63,159
1937	485,115	62,941

* Included in production of wire nails.

✦ ✦ ✦

PRODUCTION cut nails last year at 21,808 tons compared to 23,495 tons in 1936 and 27,669 tons in 1928.

✦ ✦ ✦

New Metal Product in France

A NEW product called "RUBAFER" — a steel band rolled cold—is stated to have been produced by the Fabrique de Fer de Maubeuge of **France**, advises the U. S. Department of Commerce Bureau of Foreign and Domestic Commerce. It is stated that the material can be delivered in strips or rolls in thickness from 1/10 to 14/10 mm. and in widths of from seven mm. to one meter, and in any length. It is particularly adaptable for use as a base for plating, for the making of panels, and in the construction of baskets as well as for all work where pliable material can serve.

✦ ✦ ✦

M. V. Dreyspool Appointed American Agent for Globe Wire Die Co., Dijon

THE Globe Wire Die Company of Dijon, France, manufacturers of carbide and diamond dies, have appointed M. V. Dreyspool, 299 Madison Avenue, New York City to be their representative in the United States.

✦ ✦ ✦

THIS company states that it is one of the oldest in the world for the making of diamond wire drawing dies, having been established in 1872 at Trevoux (Ain) to supply the French market only.

✦ ✦ ✦

IN 1913 the company opened new works to supply German and Austrian markets at Geneva, Switzerland but as a result of the war this activity was stopped, as the complete production was absorbed by the allied countries for war activities.

✦ ✦ ✦

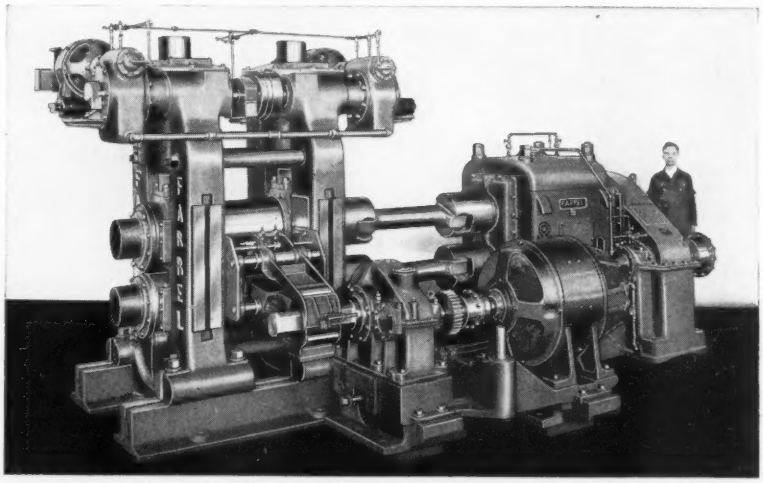
IN 1926 the company acquired some other small properties and transferred all the works to Folie-Couzon (Haute-Marne) under the name of Ateliers Ferret-Goglio.

✦ ✦ ✦

IN 1936 the company opened new works at Dijon and recently bought the plant and material of B. Pelletier Pere at Trevoux (Ain). All works and plants are owned by Ateliers Ferret Goglio with the head office at Folie-Couzon (Haute-Marne).

✦ ✦ ✦

THE Globe Wire Die Company is the sales organization for the above combination of companies and state that they are able to supply diamond dies in any quantity desired, as well as "Glowidie" dies which are a synthetic carbide composition die.



FARREL
HIGH SPEED BRASS MILL

This mill is designed to roll brass strip up to 750 feet per minute. It has 18" x 24" alloy iron rolls, with journals operating in precision type, flood-lubricated sleeve bearings and connected to the pinion stand by universal spindles.

The double motor screw-down provides individual adjustment for each screw or simultaneous adjustment of both. A magnetic clutch permits the separate operation of each screw or their synchronization when both ends of the roll are to be adjusted together. A Selsyn-controlled indicator on the operator's desk shows the amount of adjustment to .0001", enabling the operator to control the gauge of the strip very closely.

The material is blocked on solid blocks at constant tension and is wrapped by means of a jaw type wrapper. Full blocks are stripped by an air-operated stripper.

The reduction gear drive and pinion stand are combined in an integral unit, with Sykes continuous tooth herringbone gears and pinions mounted in anti-friction roller bearings. Built-in oil pump provides spray lubrication of the gear teeth and flood lubrication of the bearings.

This mill is typical of the modern design features built into Farrel Rolling Mills which permit high speed operation, increase output, improve quality and reduce production costs.

FARREL-BIRMINGHAM
Company, Inc.
38 Main St., Ansonia, Conn.

A Review of Recent Wire Patents

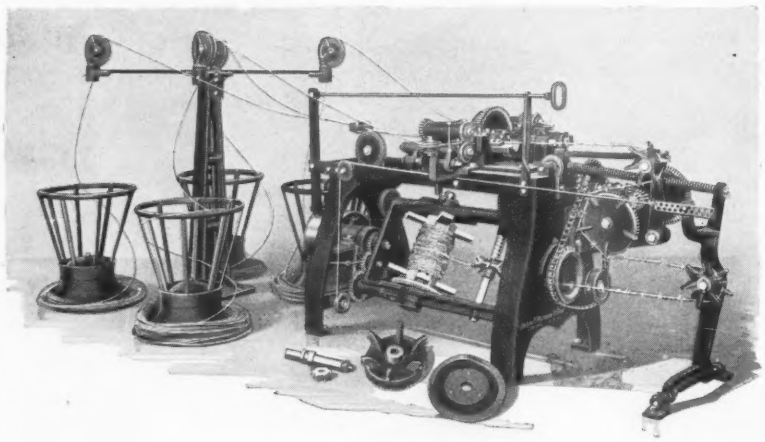
No. 2,113,135, NONSAGGING UPHOLSTERY SPRING BOTTOM, Patented April 5, 1938 by Louis Goodman, Bronx, New York.

Tension springs support the burlap sheet which carries the cushion springs against sagging below the level of the bottom of the frame, without interfering with the flexibility of the burlap sheet. The tension springs are supported by special hooks attached to the frame and are provided with adjusting means.

Complete Descriptions and Drawings of Patents May Be Had for 25 cents. Address, Wire & Wire Products, 17 East 42nd St., New York.

No. 2,113,228, METHOD OF JOINING WIRES, Patented April 5, 1938 by William H. Bassett, Jr., Scarsdale, and Arthur A. Jones, Hastings on Hudson, N. Y., assignors to Anaconda Wire & Cable Company, New York, N. Y., a corporation of Delaware.

Glader Barbed Wire Machine



The GLADER Barb Wire machine is used throughout the world for the production of Barb Wire of any type or style of 2-point or 4-point wire, made from round wire.

The machines are furnished to make 2-point or 4-point wire, and with the necessary extra parts, can be arranged to make both 2-point and 4-point wire on the one machine.

The GLADER machine is very compact in construction and the main chain of gearing that drives the barb coiling mechanism is of cast-steel with machine cut teeth.

WM. GLADER MACHINE WORKS

210 No. Racine Ave. **Chicago, Ill., U. S. A.**

Soft non-ferrous wires, such as copper wires, are joined by the use of a metallic sleeve so as to form a bond having good mechanical and electrical characteristics. The method involves hardening the ends of the wires by cold working prior to their insertion in the connecting sleeve so that the completed joint will be of uniform hardness.

✦ ✦ ✦

No. 2,113,265, METHOD AND APPARATUS FOR MAKING JOINTS IN WOVEN WIRE FABRIC, Patented April 5, 1938 by Edward J. Buell, Niagara Falls, N. Y., and Francis D. Martin, Niagara Falls, Ontario, Canada.

Wire joints are made continuously in a woven wire fabric, notwithstanding the relatively fine mesh of the fabric or the width of the belt on which the seam is to be used. The invention is applicable not only for making seams in which a strip containing fusible material is interposed between the ends of the fabric but also in making other types of seams.

✦ ✦ ✦

No. 2,113,266, METHOD AND APPARATUS FOR MAKING JOINTS IN WOVEN WIRE FABRIC, Patented April 5, 1938 by Edward J. Buell, Niagara Falls, N. Y., and Frederick C. Few, Niagara Falls, Ontario, Canada.

The joint is made by utilization of an interposed strip of fusible metal alone, or of fusible metal surrounding a non-fusible core in a manner which enables the heat to be applied continuously throughout the width of the fabric. The moving parts are compactly arranged and the interposed strip is introduced into the seam space progressively, so that the unheated portion of the strip will not be forced out of place before the heating operation is completed.

✦ ✦ ✦

No. 2,113,377, SPRING CUSHION STRUCTURE, Patented April 5, 1938 by Abraham Krakauer, Brooklyn, N. Y., assignor to Kay Manufacturing Corporation, Brooklyn, N. Y., a corporation of New York.

In the end coils of the springs, suitably shaped diametrically opposed looped locking portions are provided by means of which adjacent springs may be interlocked with each other or with a frame or brace wire in hinged relation by means of indented wires passing through the locking portions.

✦ ✦ ✦

No. 2,113,428, WIRE COILING MACHINE, Patented April 5, 1938 by Atto N. Hanna, Newark, N. J., assignor to Parallex Corporation, Newark, N. J., a corporation of N. J.

The mechanism produces spiral coils for use in binding the leaves of books having a sequence of openings along one edge in which the coils are threaded. The diameter and pitch of the coils are capable of exact regulation. The forming die has a circular opening corresponding in diameter with that of the convolutions of a coil being produced and a guide slot extending tangentially of the opening.

No. 2,113,674, MANUFACTURE OF STRANDED ELEMENTS, Patented April 12, 1938 by Alan E. Brickman and George A. Gleason, Worcester, Mass., assignors to The American Steel and Wire Company of New Jersey, a corporation of N. J.

A stranded cable is separated into shorter lengths having die cast end fittings by first die casting metal about the cable at spaced positions defining the shorter lengths and then severing the metal and the cable to produce the shorter lengths.

✦ ✦ ✦

No. 2,113,698, MEANS FOR AUTOMATICALLY STOPPING STRANDING, CABLING, AND ROPE MAKING MACHINES, Patented April 12, 1938 by John Hamilton Larmuth, Hill Crest, Upper Colwyn Bay, North Wales.

On each bobbin cradle is provided a roller, mounted in a swing bracket and resting on the wire, strand or thread near the place where the same travels through the eye of the cradle. The roller is adapted to act on a lever which controls an electric contact adapted to cooperate with a contact on the cradle support when the lever is acted on by the bracket, whereby electricity may be employed as the power for stopping the machine.

✦ ✦ ✦

No. 2,113,710, METALLIC ROPE, Patented April 12, 1938 by Harvey W. Riddle, Worcester, Mass., assignor to The American Steel and Wire Company of New Jersey, a corporation of New Jersey.

Around a center is laid a plurality of spirally disposed strands each composed of a pair of wires, the twist of each strand being such that one revolution around the assembly will contain three half twists, whereby to produce of core or a wire rope of triangular cross-section.

✦ ✦ ✦

No. 2,113,905, FILAMENT FOR INCANDESCENT LAMPS AND METHOD OF MANUFACTURING THE SAME, Patented April 12, 1938 by Jakob Salpeter, Vienna, Austria.

The drawn tungsten wire, which is inclined to form large overlapping crystals on heating by known methods, is heat treated on a mandrel at a temperature such that no change in crystal structure develops, that is, between 600° and 900°C., the mandrel is removed, and the filament is heat treated at a higher temperature which is still below the recrystallization temperature of the tungsten, that is, approximately 1100°C.

✦ ✦ ✦

No. 2,114,120, MACHINE FOR AUTOMATICALLY MANUFACTURING CONCENTRIC CONDUCTORS ADAPTED FOR ELECTRICAL COMMUNICATIONS, Patented April 12, 1938 by Hitoshi Yasuoka, Tokyo, Japan, assignor to The Fujikura Electric Cable Works, Ltd., Tokyo, Japan.

In spaced relation about the central conductor is a spiral supporting wire, tied by a continuous insulator string which firmly supports the central conductor in the axis of the spiral supporting wire, whereby to dispense with massive distance pieces, reduce the static capacity and increase the flexibility of the concentric conductor.

No. 2,114,180, CONVEYOR BELT, Patented April 12, 1938 by Raymond J. Guba, Philadelphia, Pa., assignor to Audubon Wire Cloth Corporation, Philadelphia, Pa., a corporation of N. J.

The structure includes a pair of spaced drive chains between which are disposed sections of fabric consisting of interconnected helically coiled wires transversely of the chains. The fabric is hung from cross-bar connections comprising loose sleeve elements spacing the chains at regular intervals, and is maintained in a central position between the chains by resilient means such as coil springs which are continuous with the coiled wires surrounding the tubular members of the cross-bar connections.

No. 2,114,181, CONVEYOR BELT, Patented April 12, 1938 by Raymond J. Guba, Philadelphia, Pa., assignor to Audubon Wire Cloth Corporation, Philadelphia, Pa., a corporation of N. J.

A continuous belt is made of helically coiled wires in interconnected relation, and associated with cross rods whose ends are permanently attached to a series of connecting members which may be chain links, and which form a selvage at each side of the belt fabric.

✦ ✦ ✦

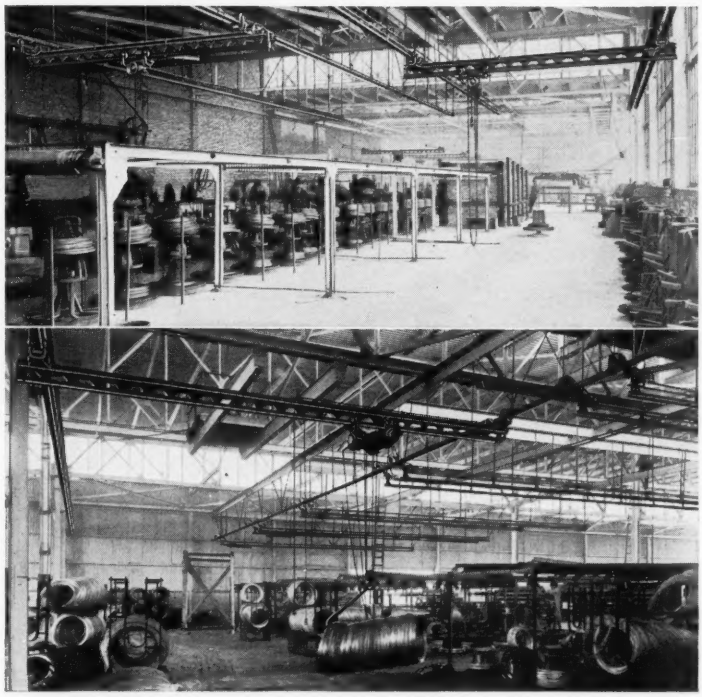
No. 2,114,182. CONVEYOR BELT, Patented April 12, 1938 by Raymond J. Guba, Philadelphia, Pa., assignor to

(Please turn to Page 314)

CLEVELAND TRAMRAIL

MATERIALS HANDLING EQUIPMENT

In the Wire and Wire Products Industry



● Cleveland Tramrail hand operated cranes, carriers and hoists are fast, easily propelled, and effective equipment for servicing reels in any wire galvanizing department, and looms in the fence department. These photos were taken before the second row of reels was completed.

Consult your phone directory under Cleveland Tramrail.

CLEVELAND TRAMRAIL

Division of

THE CLEVELAND CRANE & ENGINEERING CO.

1141 Depot St.

WICKLIFFE, OHIO

A Review of Recent Wire Patents

(Continued from Page 313)

Audubon Wire Cloth Corporation, Philadelphia, Pa., a corporation of N. J.

A belt is formed from helically coiled interconnected wires associated with cross bars whose ends are connected to a series of overlapping upstanding plate members at the marginal edges of the belt.

✦ ✦ ✦

No. 2,114,400, STRAND WRAPPING MACHINE, Patented April 19, 1938 by Edward G. Parvin, Roselle, N. J., assignor, by mesne assignments, to Syncro Machine Company, Newark, N. J., a corporation of New Jersey.

The mechanism is synchronized to apply a uniform helical wrap of either adjacent or overlapping convolutions of a strip of insulating material onto a heavy electrical conductor. The distributor is provided with an electrically interconnected motor drive system which lays the finished product onto the take-up reel in uniform layers, and the generator moves in timed relation with the movement of the wire.

✦ ✦ ✦

No. 2,114,496, METHOD OF AND APPARATUS FOR COMBINING STRANDS, Patented April 19, 1938 by Herbert S. Keating, North Plainfield, N. J., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

In the manufacture of communication cables, it is in some instances desirable to adjust the capacitance relation of the individual strands. The invention describes a method and apparatus for intertwisting strands with or without a core with predetermined cyclic variations of lay, the apparatus including a core supply, a rotatable conductor supply and twisting unit, a capstan and take-up unit and a driving and speed control unit.

✦ ✦ ✦

No. 2,114,632, WIRE DRAWING MACHINE, Patented April 19, 1938 by Otho L. Giffin, Worcester, Mass.

A series of dies, drawing blocks and accumulators reduces the wire or rod in a high-speed continuous operation to a desired size and compensates for variations in die sizes and prevents slippage of the wire on the drawing blocks, although each succeeding block in the series is rotated to draw the wire through a die at a rate which is slower than the rate of supply of wire to its cooperating die.

✦ ✦ ✦

No. 2,114,918, SPRING, Patented April 19, 1938 by Ernst F. Engstrom, Maywood, Ill.

A single piece of wire is shaped to form a plurality of V-shaped elements lying in a horizontal plane and a plurality of S-shaped elements lying in vertical planes and interconnected by the V-shaped elements, the spring structure being applicable to furniture and vehicle cushions.

✦ ✦ ✦

No. 2,115,649, METHOD OF BONDING THE ENDS OF WIRE ROPES, Patented April 26, 1938 by Frank E. Stahl, Tonawanda, N. Y., assignor to Columbus McKinnon Chain Corporation, Tonawanda, N. Y., a corporation of N. Y.

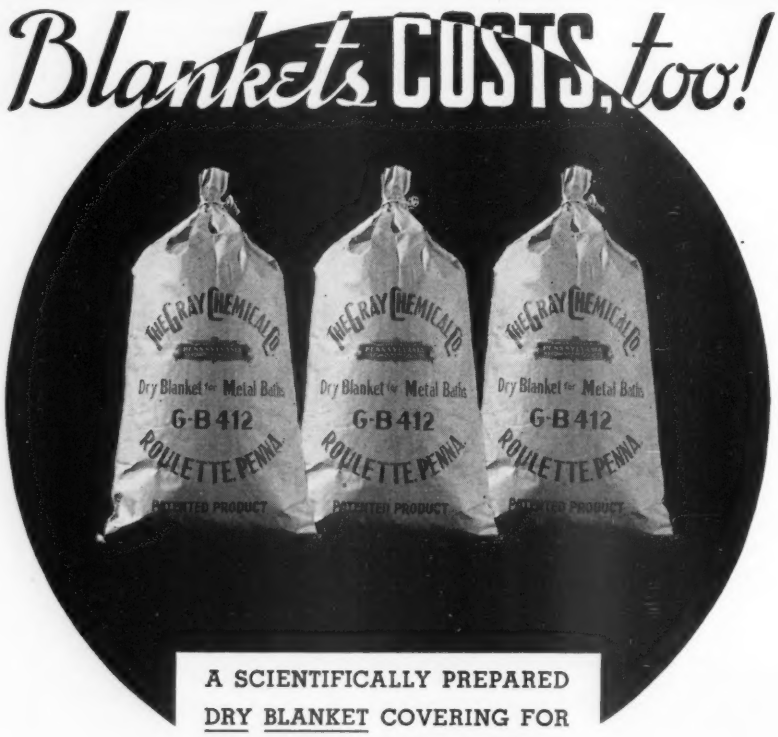
Clamped between a pair of spaced pivotally mounted blocks, is a wire rope which is severed by means of an oxyacetylene flame between the blocks, which are then swiveled, while still firmly holding the severed ends of the rope, to positions wherein the ends may conveniently be welded.

✦ ✦ ✦

No. 2,115,652, APPARATUS FOR BONDING THE ENDS OF WIRE ROPES, Patented April 26, 1938 by Frank E. Stahl, Tonawanda, N. Y., assignor to Columbus McKinnon Chain Corporation, Tonawanda, N. Y., a corporation of N. Y.

Pivoted between the jaws of a vise and at one side thereof is a pair of primary clamping blocks for receiving wire rope as it comes from the supply reel, and in interspaced relation to the primary blocks is a pair of secondary clamping blocks at the opposite side of the vise, the secondary blocks being pivotally and slidably attached each to its co-acting vise jaw by means of a screw.

Blankets COSTS, too!



A SCIENTIFICALLY PREPARED DRY BLANKET COVERING FOR MOLTEN METAL BATHS OF ZINC, LEAD, TIN AND THEIR ALLOYS

The very fact that this *NEW* preparation has proved economical in its every application, should well warrant its trial on your galvanizing baths.

G. B. 412 GALVANIZERS' BLANKET

BLANKET prevents loss of heat by radiation... Saves 35% to 50% of fuel... Prevents oxide formation... Is safe to handle and *Easily applied.*

Astonishing savings in costs and labor rank it paramount in its field. G. B. 412 GALVANIZERS' BLANKET

May we supply you with additional information together with proof of its superiority?

GRAY CHEMICAL COMPANY ROULETTE, PA. (Potter County) Phone Roulette 2131

FORTY YEARS OF SUCCESSFUL SERVICE

The Davis Sparker

THIS is a machine designed to work in conjunction with a continuous vulcanizer and to automatically detect dielectric faults or defects in the insulation while the wire is being manufactured. It immediately notifies the operator of the machine of the presence of such defects by automatically blowing a horn calling attention to the fact that the machine is not functioning properly.

✦ ✦ ✦

THE machine is equipped with a totalizer which counts the number of faults on the machine, and this is resetable at the end of each day. There is a second counter which operates as a check on the first counter so that in the event of the first counter missing any faults, the second counter still shows the total number of faults. The second counter is not resetable and thus acts as an automatic check on the first counter.

✦ ✦ ✦

BY applying this method of indication, each particular reel of wire manufactured can have the individual number of faults in that particular reel indicated. Bad wire is immediately sorted out from good wire, and the bad wire repassed through the counter. In this way the entire output of the machine is saved and utilized.

✦ ✦ ✦

IN addition to this the transformer is equipped with nine voltages which will take care of all insulations from a very light wall to the heaviest wire that runs through the machine.

✦ ✦ ✦

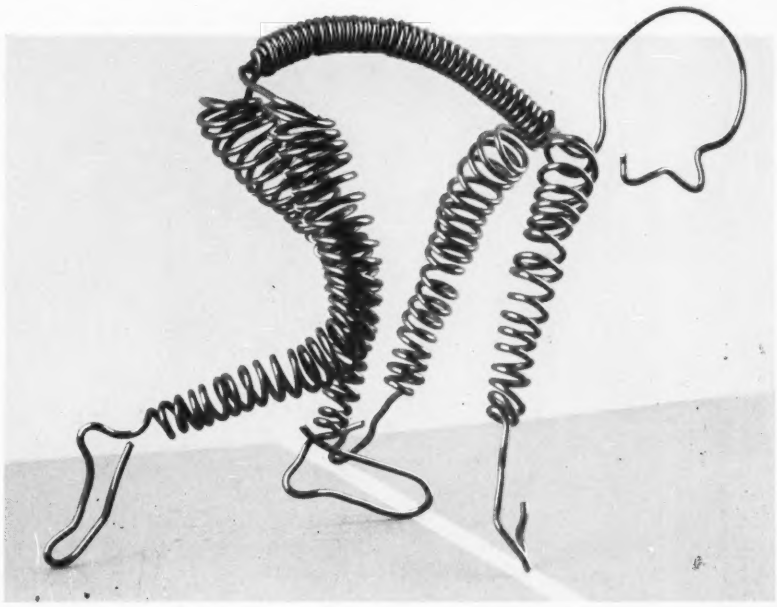
THE wire in the test travels through an electrode 18 inches long which is of sufficient length to give ample time for the wire to break down. This electrode is made in two parts. The upper part is attached to the cover of the machine so that to insert the wire the cover is merely lifted. This leaves plenty of room to handle the wire.

✦ ✦ ✦

ON the side of the cover is a built-in limit switch that immediately cuts off the voltage from

(*Please turn to Page 324*)

A FAST START - - -



Keystone wire is fast to get into smooth production stride when you start it through your machines. That's because it is carefully trained and conditioned by Keystone technicians to meet your special requirements. It'll always show the same beautiful form—for Keystone uniformity is maintained under positive laboratory control.

Like to have more specific details? Just give us the gun!

KEYSTONE

STEEL & WIRE CO., Dept. W, PEORIA, ILL.

HIGH CARBON
or
LOW CARBON

SAMSON
REG. U.S. PAT. OFF.
SPRING WIRE
KEYSTONE STEEL & WIRE CO. PEORIA, ILL.

Bright . . . Tinned
Coppered
Annealed
Galvanized

TRIP ABROAD

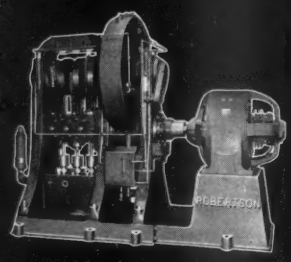
Paid for out of the $avings!

Dependable performance over long periods of time is required on all extrusion equipment, especially cable lead encasing presses.

Robertson hydraulic pumps give that dependable performance and require a minimum of maintenance.

Automatic lubrication is only one of the fourteen distinctive features which make this pump dependable.

Complete description gladly furnished.



ROBERTSON

HYDRAULIC PUMP

JOHN ROBERTSON COMPANY, INC.

125-137 Water Street, Brooklyn, N. Y.

The Institute of Metals of Great Britain, 30th Annual General Meeting, London, March 8 to 10th, 1938

A Synopsis of Papers

Paper (789) on "The Nickel-Copper-Magnesium Alloys", by Professor W. R. D. JONES, D.Sc., Member, (Dept. of Metallurgy and Fuel Technology, University College, Cardiff) and K. J. B. WOLFE, M.Sc., (Research Student, University of Wales), presented on WEDNESDAY, March 9.

✦ ✦ ✦

EXPERIMENTS have been carried out on the effect of adding copper and nickel to magnesium. The improved mechanical properties given to magnesium, when in the cast condition, by small additions up to about 2 per cent. copper are enhanced by the addition of nickel, if the combined alloy content be 2¼-2½ per cent. A nickel content of 0.5-1 per cent. (in the combined alloy content) has a greater effect than a corresponding copper content. These alloys are forged or rolled readily and, provided that care is taken to prevent cold-work, reasonably good ductility values are obtained. In the case of forged or rolled alloys, the beneficial effect of the addition of nickel as well as copper is not so pronounced; the effect of nickel depends to some extent on the proportion of copper present in the alloy. Billets which have been rolled after a preliminary drawing give better mechanical properties than those which have been drawn down to the same size.

✦ ✦ ✦

Paper (797) on "Alloys of Magnesium. Part VII.—The Mechanical Properties of Some Wrought Aluminium-Magnesium and Silver-Aluminium-Magnesium Alloys", by John L. HAUGHTON, D.Sc., Member, (Principal Scientific Officer, Dept. of Metallurgy and Metallurgical Chemistry, The National Physical Laboratory, Teddington), and A. E. L. TATE, (Assistant, Dept. of Metallurgy and Metallurgical Chemistry, The National Physical Laboratory, Teddington), presented on WEDNESDAY, March 9.

✦ ✦ ✦

THE mechanical properties of pressed magnesium alloys containing up to 10 per cent. of aluminium, with and without the addition of silver, were studied.

✦ ✦ ✦

THE effect of various amounts of reduction during forging was investigated, as well as the effect of the temperature at which

the forging took place. It is shown that forging at 200°C., after a preliminary breaking down at 380°C., causes a marked increase in tensile strength, without appreciable loss of ductility, particularly in the case of alloys containing a small quantity of silver. The highest tensile strength was obtained with an alloy containing 8.5 per cent. aluminium and 4.2 per cent. silver, and the best elongation with an alloy containing 4 per cent. aluminium and 1.5 per cent. silver, the ultimate stresses being 30 and 24 tons/in.^{2}, and the elongations 5 and 13.4 per cent., respectively.

✦ ✦ ✦

SPECIAL attention may be directed to the alloy containing 6.5 per cent. of aluminium and 1.5 per cent. of silver, which has an ultimate stress of 27.3 tons/in.^{2}, a 0.1 per cent. proof stress of 21.3 tons/in.^{2}, and an elongation of 11.5 per cent.

✦ ✦ ✦

Paper (798) on "Sintered Alloys. Part I.—Copper-Nickel-Tungsten Alloys Sintered with a Liquid Phase Present", by G. H. S. PRICE, B.Sc., Member, C. J. SMITHELLS, M.C., D.Sc., Member of Council, and S. V. WILLIAMS, B.Sc., Member. (Communication from the Staff of the Research Laboratories of The General Electric Co., Ltd., Wembley), presented on WEDNESDAY, March 9.

✦ ✦ ✦

FACTORS which influence the preparation of alloys made by mixing, pressing, and sintering metal powders in an atmosphere of hydrogen have been investigated with particular reference to the copper-nickel-tungsten system. The distinctive character of the work is that sintering has been carried out at temperatures sufficiently high to ensure the presence of a liquid phase during the formation of the alloy.

✦ ✦ ✦

THE effect of time and temperature of sintering has been investigated with a copper 2, nickel 5, and tungsten 93 per cent, alloy. Alloy formation, determined by density measurements and microexamination, does not progress uniformly as the sintering temperature is increased, but shows a rapid increase at a temperature of about 1300°C. Although considerable solid diffusion may occur at

(*Please turn to Page 318*)

Heavy Duty Rod Breakdown Wire Drawing Machine For All Non Ferrous Materials

Maximum size of entering rod	7/16"
Size of finished wire	#2 to #14 B & S gauge
Maximum operating speed	3100 F. P. M.
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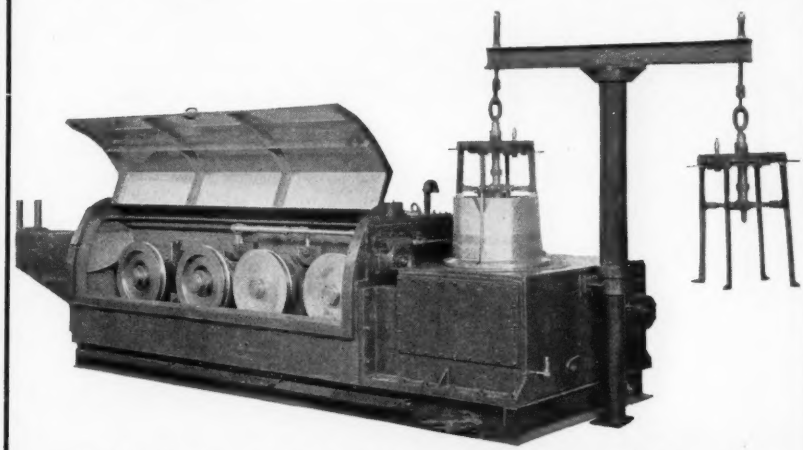
Number of drawing block shafts	4
Maximum motor size	200 H. P.



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(*Continued from Page 306*)

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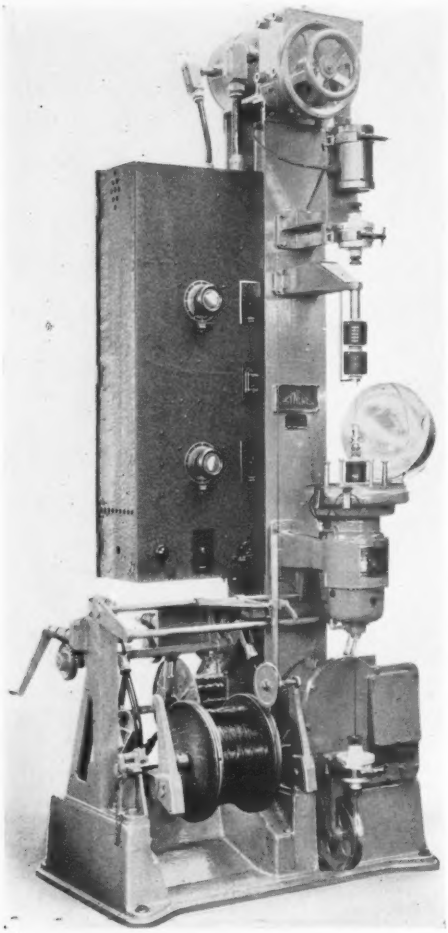

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British Institute of Metals Synopsis of Papers

(*Continued from Page 317*)

lower temperatures, it is essential that this temperature should be exceeded if alloys of "theoretical" density are to be obtained.

✦ ✦ ✦

THE time for which the alloys must be held at the sintering temperature to reach equilibrium is largely dependent on the composition. An alloy having a high percentage of the liquid phase reaches its "theoretical" density sooner than one in which the amount of liquid phase present is small.

✦ ✦ ✦

THE effect of composition has been investigated for a series of alloys containing from 80 to 97 per cent. tungsten. With copper only, the tungsten particles are merely wetted and cemented together; there is no grain-growth and much porosity. With nickel only, the full density is obtained after sintering above 1500°C. When both copper and nickel are present, two factors are important: the ratio of nickel to copper, and the total percentage of these metals. Maximum density is obtained when the nickel-copper ratio is about 2:1 and the tungsten content lies between 89 and 93 per cent.

✦ ✦ ✦

A FOURTH fundamental variable is the fineness of the metal powders, a longer time, or a higher temperature, being required for complete sintering when the tungsten grains are coarse. Fully-sintered alloys prepared in this way have no porosity, densities equal to the "theoretical" values, and a tensile strength up to 40 tons/in.^{2}. Microexamination reveals the presence of large, rounded tungsten grains, whose diameter is about 100 times that of the original particles, embedded in a continuous matrix of copper-nickel phase saturated with tungsten.

✦ ✦ ✦

AN explanation of the changes which take place during sintering, based on the abnormal solubility of particles less than 1 μ in diameter, accounts satisfactorily

for all the observations. This hypothesis has been confirmed by results obtained with sintered silver-copper and copper-iron alloys.

✦ ✦ ✦

Paper (791) on "The Creep of Tin and Tin Alloys.—Part II.", by Professor D. HANSON, D.Sc., Vice-President, (Professor of Metallurgy, University of Birmingham) and E. J. SANDFORD, B.Sc., Member, (Dept. of Metallurgy, University of Birmingham), presented on March 9.

✦ ✦ ✦

A DESCRIPTION is given of results of creep tests on alloys of tin with 2 to 7 per cent. cadmium and 3 to 9 per cent. antimony. The influence of annealing at 170° and 200°C. is discussed. After cold-rolling and self-annealing, the best alloy is that containing 7 per cent. cadmium and 9 per cent. antimony; it withstands a stress of 1200 to 1400 lb./in.² for many years. After annealing at 170°C., the most beneficial composition is 2 per cent. cadmium and 7 per cent. antimony; a safe stress for this alloy is 3500 lb./in.². Annealing at 200°C. produces optimum creep properties at a composition of 3 per cent. cadmium and 7 per cent. antimony; a safe stress in this case is 3700 lb./in.². It is shown that grain-size is an important factor in determining creep-resistance, and therefore, as the tensile strength is not greatly influenced by grain-size, no relationship is found between these two properties in the annealed alloys investigated. The effect of additions of 1 and 2 per cent. silver, 1 per cent. copper, or 0.3 per cent. nickel is discussed. The silver and copper alloys show similar creep properties, but the nickel alloy is inferior. An alloy containing 1 per cent. cadmium and 3-5 per cent. silver has great creep-resistance when cold-rolled and self-annealed; it is superior to the alloy containing 7 per cent. cadmium and 9 per cent. antimony.

✦ ✦ ✦

Paper (792) on "The Physical and Mechanical Properties of Nickel-Brasses", by Maurice COOK, M.Sc., Ph.D., Member, (Deputy Research Manager, I. C. I. Metals, Ltd., Witton, Birmingham), presented on WEDNESDAY, March 9.

(*Please turn to Page 320*)

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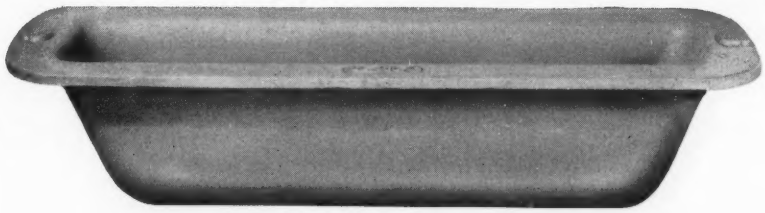

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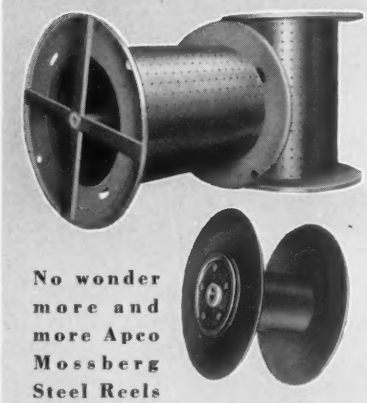

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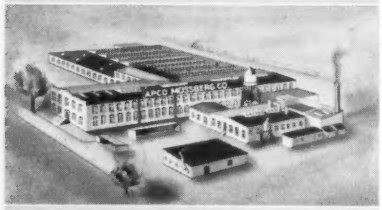

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British Institute of Metals
Synopsis of Papers

(*Continued from Page 319*)

AFTER a preliminary study of the physical properties of alloys containing copper from 60 to 25, nickel 5 to 30, and zinc 30 to 55 per cent. in the chill-cast condition and in the form of bar, hot-forged from chill-castings, a more detailed examination has been made of the properties of a few selected alloys in the form of extruded rod, with and without small additions of alloying elements. In addition to determinations of the physical properties of the extruded materials, observations have been made on the microstructure, machinability, and hot-stamping characteristics of the alloys.

✦ ✦ ✦

Paper (793) on "The Influence of Alloying Elements on the Crystallization of Copper. Part I.—Small Additions and the Effect of Atomic Structure", by L. Northcott, Ph.D., M.Sc., F.I.C., Member, (Research Department, Woolwich), presented on WEDNESDAY, March 9.

✦ ✦ ✦

THE influence has been determined of additions of from 0.1 to 2 per cent. by weight of alloying elements on the size of columnar crystals of copper cast into moulds specially designed to ensure unidirectional solidification. Different elements produced widely different effects on the crystallization of the copper. The results are discussed from the points of view of composition gradient and adsorption effects. The temperature gradients in the ingot during and after solidification have been measured. An examination of the valency and atomic structure of the added elements shows a correspondence between these and what has been termed the "crystal growth-restriction factor."

✦ ✦ ✦

Paper (787) on "A Study of Some of the Factors Controlling the Porosity of Hot-Tinned Coatings on Copper", by W. D. JONES, M.Eng., Ph.D., Member, (Lecturer in Metallurgy, The Sir John Cass Technical Institute, London), presented on March 9.

✦ ✦ ✦

A DISTINCTION is drawn between the surface conditions of a tin bath (in which copper is being tinned) at the entry of the copper and at the exit. Molten

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salts and other materials maintained on the bath at entry are termed **fluxes** and control the wetting of the copper surface by the tin; and such materials at the exit from the bath are included in the term **cover,** and control the stability of the molten tin film on the copper surface after it has left the bath.

✦ ✦ ✦

A MAJOR source of porosity in tin coatings on copper is due to a "running off" or "globularizing" of the molten tin film. This phenomenon is termed **dewetting** and is indicative of an instability in the molten tin film caused mainly by a high tin surface tension. Certain covers such as palm oil, stannic bromide, oxide films, etc., by reducing surface tension decrease the tendency to dewet. Other covers, such as ammonium chloride, or resin, permitting of a high surface tension, increase the tendency to dewet. Dewetting is favoured by the presence of suitable nuclei, of which the most important are scratches and other discontinuities of the copper surface, imperfectly wetted areas, inclusions, and local variations in surface tension caused by temperature and concentration variations. The extent of dewetting is reduced by increasing the viscosity of the tin film (by presence of intermetallic compounds and by low temperatures) or by rapid solidification.

✦ ✦ ✦

THE experiments upon tin films on copper concerning dewetting have been duplicated, employing water films on a gold plate.

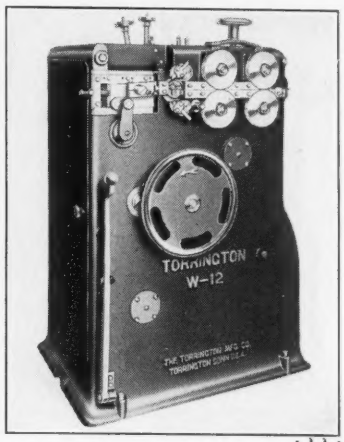
✦ ✦ ✦

Paper (790) on "The Influence of Surface Alloying on the Strength of Soft Soldered Joints", by R. CHADWICK, M.A., Member, (Research Metallurgist, I.C.I. Metals, Ltd., Birmingham), presented on WEDNESDAY, March 9.

✦ ✦ ✦

THE joining of copper strip 0.005″ thick by a series of alloys of lead and tin, including the pure metals themselves, has been studied. Joints were tested by pulling apart the two strips, adjacent ends of the strip being held in the jaws of the tensile machine. Except with pure lead joints, in

(*Please turn to Page 322*)



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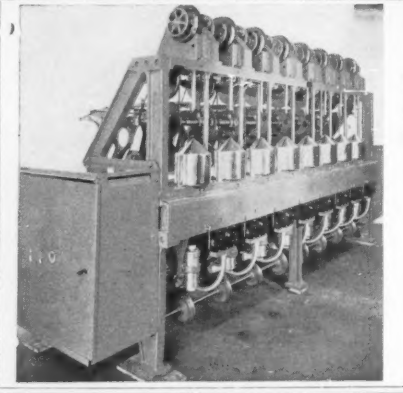

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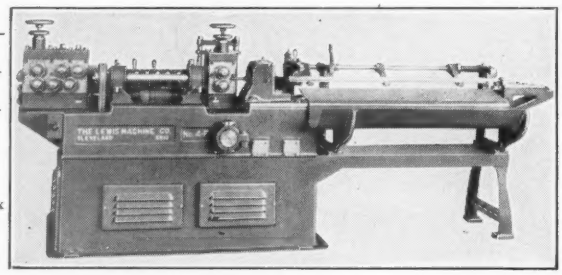

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(*Continued from Page 321*)

which shear of the lead itself occurred, this test produced failure by stripping of the solder from the copper strip. This failure was shown to be due to the presence of a brittle copper-tin alloy film. Owing to the rapid growth of this alloy film, the time and temperature of joining had a profound effect upon joint strength.

✦ ✦ ✦

A RAPID method was developed of making joints under reproducible conditions, and joints so prepared were aged at temperatures from 100° to 500°C. After ageing at 100, 200 and 300°C. the surface film contained only two phases, i.e. ε and η, but at 400°C. and 500°C. a third phase ζ was developed. The part played by each individual phase in the strength of the joints was determined, ε and ζ were found to be much weaker than the intermediately situated η.

✦ ✦ ✦

FOR H. C. copper the joint strengths obtained by prolonged ageing did not fail below the characteristic strength of the weakest copper-tin alloy, in which failure occurred. For some lower grades of copper however, brittleness developed at the η-copper interface (ζ being absent) and this ultimately resulted in the joint strength falling to zero. This type of failure was found to depend upon the presence of both arsenic and oxygen in the copper, and it is presumed that a complex oxide film was formed.

✦ ✦ ✦

JOINTS made with pure lead formed no alloy film, and consequently there was no appreciable loss in strength on ageing under any of the conditions investigated.

✦ ✦ ✦

THE fall in strength of joints due to the development of a brittle alloy surface film was slightly more rapid for the lead-tin alloys then for pure tin, probably due to the greater uniformity of the alloy layers produced. The second type of failure, resulting in complete stripping at the copper —η interface, was found to be

greatly accelerated by the presence of lead, rapid failure being observed for a 2 tin 98 lead alloy.

✦ ✦ ✦

THE desirability of avoiding oxygen bearing arsenical copper in making soft solder products for use at elevated temperatures is pointed out. It is suggested however, that where possible, lead base alloys free from tin might be substituted for the conventional lead-tin solder, giving the advantage of stronger joints free from deterioration at all temperatures of ageing.

✦ ✦ ✦

Exports and Imports of Wire

(*Continued from Page 308*)

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✦ ✦ ✦

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✦ ✦ ✦

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✦ ✦ ✦

EXPORTS of brass wood screws during the same month totaled 3,485 gross valued at $1,565. Of this total Colombia took 863 gross valued at $248; Canada 685 gross valued at $477; Bermuda 474 gross valued at $207; New Zealand 346 gross valued at $143; Panama 179 gross valued at $52; Chile 155 gross valued at $60.

✦ ✦ ✦

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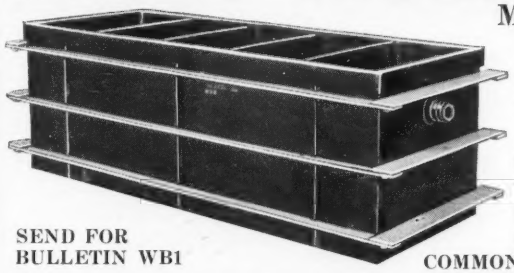

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(*Continued from Page 287*)

pose, while the temperature of the steel is measured with a couple near the base of the pile. An annealing temperature of 1300-1400 deg. is generally used, and the annealing cycle requires about 24 hrs., 8 hrs. for heating and soaking, and 16 hrs. for cooling and recharging.

✦ ✦ ✦

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✦ ✦ ✦

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✦ ✦ ✦

The Davis Sparker

(*Continued from Page 315*)

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✦ ✦ ✦

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AT a meeting of the shareholders of the Northwestern Barb Wire Company, Sterling, Ill., the corporate name of the company was changed to the Northwestern Steel & Wire Company, according to James C. Foster, president.

✦ ✦ ✦

"Continuous growth and expansion of the business with increased facilities and greater diversification of products pointed the way to this new company name, as it clearly expresses to the trade the entire scope of our business which now includes the Sterling line of electric steel billets, rods, bars, bands, angles, shapes; also nails, barbed wire, fencing, netting, bale ties, hardware cloth and related items," stated Mr. Foster.

✦ ✦ ✦

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ABRASIVES—
Norton Co., Worcester, Mass.

ALLOY CASTINGS—
Trenite Corp., Trenton, N. J.

ANODES—Nickel
Seymour Mfg. Co., The, Seymour, Conn.

ANNEALING POTS AND BOXES—
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.

ANTI-RUST—
Magnus Chemical Co., Garwood, N. J.

ARMORING EQUIPMENT—
American Insulating Mach'y, Co., Phila., Pa.
Elevator Supplies Co., Inc., Rahway, N. J.
New England Butt, Co., Providence, R. I.
Seymour Mfg. Co., The, Seymour, Conn.
Sleeper & Hartley, Worcester, Mass.
Watson Machine Co., Paterson, N. J.

BAKERS—Rod and Wire
Morgan Construction Co., Worcester, Mass.

BOBBINS—
Apco-Mossberg Co., Attleboro, Mass.

BORON CARBIDE—
Norton Co., Worcester, Mass.

CEMENT FLOOR CLEANER—
Magnus Chemical Co., Garwood, N. J.

CEMENTS—Refractory
Norton Co., Worcester, Mass.

CHEMICALS—Cleaning
American Chemical Paint Co., Ambler, Pa.
Magnus Chemical Co., Garwood, N. J.

CLEANERS—Hand and Metal
Magnus Chemical Co., Garwood, N. J.

CLEANING & PICKLING EQUIPMENT—
Broden Construction Co., Cleveland, O.
Duriron Co., The, Dayton, O.
Haveg Corp., Newark, Del.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

COATING—Protective
American Lanolin Corp., Lawrence, Mass.

COILERS—Sheet, Strip and Wire
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
H. J. Ruesch Machine Co., Newark, N. J.
Torrington Mfg. Co., The, Torrington, Conn.

CONDUITS—Iron and Steel
Youngstown Sheet & Tube Co., Youngstown, Ohio.

CONTROLS—Automatic
Leeds & Northrup Co., Philadelphia, Pa.

CRANES—Block Stripping
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

CRANES—Cleaning House
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

CRANES—Electrical Traveling
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

CRANES—Wire Mill
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

DIAMOND TOOLS—
Rusch Wire Die Corp., New York, N. Y.

DIES—Diamond
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Cochaud Wire Die Co., New York, N. Y.
Kelly Wire Die Corp., New York, N. Y.
Master Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.

DIES—Lead Extrusion
John Robertson Co., Brooklyn, N. Y.

DIES—Repairs & Re-Cutting
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Cochaud Wire Die Corp., New York, N. Y.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Master Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.

DIES—Rod and Tube Drawing
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Master Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.

DIES—Tantalum Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Kelly Wire Die Corp., New York, N. Y.
Master Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.

WHERE TO BUY, Continued

DIES—Tungsten Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Master Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.

DIES—Wire Drawing
Carboloy Co., Inc., Detroit, Mich.

DRAW BENCHES—
H. J. Ruesch Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.

ENGINEERS—Consulting Wire Mill
Lewis, Kenneth B., New York, N. Y.
Hartley, George D., Worcester, Mass.

EQUIPMENT—Insulation Testing
Leeds & Northrup Co., Philadelphia, Pa.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FILLERS—Paper for Cable
E. W. Twitchell, Inc., Phila., Pa.

FURNACE CASTINGS—Heat Resisting
Trenite Corp., Trenton, N. J.

FURNACE CONTROLS — Combustion
Leeds & Northrup Co., Philadelphia, Pa.

FURNACE CONTROLS—Draft
Leeds & Northrup Co., Philadelphia. Pa.

FURNACES—Annealing
Electric Furnace Co., Salem, O.
Leeds & Northrup Co., Philadelphia. Pa.
Surface Combustion Corp., Toledo, O.

FURNACES—Automatic
Electric Furnace Co., Salem, O.
Leeds & Northrup Co., Philadelphia. Pa.
Surface Combustion Corp., Toledo, O.

FURNACES—Bright Annealing
Electric Furnace Co., Salem, O.
Surface Combustion Corp., Toledo, O.

FURNACES—Electric
Electric Furnace Co., Salem, O.
Surface Combustion Corp., Toledo, O.

FURNACES—Hardening and Tempering
Electric Furnace Co., Salem, O.
Leeds & Northrup Co., Philadelphia. Pa.
Surface Combustion Corp., Toledo, O.

FURNACES—Lead Melting
Electric Furnace Co., Salem, O.
John Robertson Co., Brooklyn, N. Y.
Surface Combustion Corp., Toledo, O.

FURNACES—Non-Oxidizing
Electric Furnace Co., Salem, O.
Surface Combustion Corp., Toledo, O.

FURNACES—Normalizing
Electric Furnace Co., Salem, O.
Leeds & Northrup Co., Philadelphia. Pa.
Surface Combustion Corp., Toledo, O.

FURNACES—Wire, Strip & Sheet
Electric Furnace Co., Salem, O.
Surface Combustion Corp., Toledo, O.

GALVANIZERS' BLANKET—
Gray Chemical Co., Roulette, Pa.

GEARS—Wire Mill
Farrel-Birmingham Co., Inc., Ansonia, Conn.

GRINDERS—Roll
Norton Co., Worcester, Mass.

HANDLING EQUIPMENT — Material
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

HOISTS—Electric Traveling
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

HOISTS—Monorail
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

INHIBITORS
American Chemical Paint Co., Ambler, Pa.

INSTRUMENTS—Electrical
Leeds & Northrup Co., Philadelphia, Pa.

INSULATION — Cable or Cable Filler
E. W. Twitchell, Inc., Phila., Pa.

LATHES—Die Reaming
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Magnus Chemical Co., Garwood, N. J.

LUBRICANTS—Wire Drawing
Magnus Chemical Co., Garwood, N. J.

MACHINERY—Armoring (Cable, Wire Hose)
Amer. Insulating Mach'y Co., Phila., Pa.
Elevator Supplies Co., Inc., Rahway, N. J.
New England Butt, Co., Providence, R. I.
John Robertson Co., Brooklyn, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Braiding
Fidelity Machine Co., Philadelphia, Pa.
New England Butt, Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Brazing
Thomson-Judd Wire Machinery Co., Lynn, Mass.

MACHINERY—Bunching
Amer. Insulating Mach'y Co., Phila., Pa.
New England Butt, Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable, Electric
Amer. Insulating Mach'y Co., Phila., Pa.
Elevator Supplies Co., Inc., Rahway, N. J.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt, Co., Providence, R. I.
Thomson-Gibb Electric Welding Co., Lynn, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Chain Making
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Closing
New England Butt, Co., Providence, R. I.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coil Winding
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Coilers
Broden Construction Co., Cleveland, O.
Elevator Supplies Co., Inc., Rahway, N. J.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Morgan Construction Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Copper Wire Drawing and Rolling
Elevator Supplies Co., Inc., Rahway, N. J.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
H. J. Ruesch Machine Co., Newark, N. J.
Torrington Mfg. Co., The, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Covering Wire
Syncro Machine Co., Newark, N. J.

MACHINERY—Cutting
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Hallden Machine Co., Thomaston, Conn.
Lewis Machine Co., The, Cleveland, O.
National Machinery Exchange, New York, N. Y.
F. B. Shuster Co., New Haven, Conn.
W. A. Schuyler, New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Enameling
Amer. Insulating Mach'y Co., Phila., Pa.

MACHINERY—Extruding
John Robertson Co., Brooklyn, N. Y.
Royle, John & Sons, Paterson, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Flat Wire
Broden Construction Co., Cleveland, O.
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Forming
National Machinery Exchange, New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Galvanizing Wire
Broden Construction Co., Cleveland, O.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Gang Winders
Fidelity Machine Co., Philadelphia, Pa.
H. J. Ruesch Machine Co., Newark, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., Worcester, Mass.

MACHINERY—Insulating
Amer. Insulating Mach'y Co., Phila., Pa.
Elevator Supplies Co., Inc., Rahway, N. J.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt, Co., Providence, R. I.
Syncro Machine Co., Newark, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lead Encasing Presses, etc.
John Robertson Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
John Robertson Co., Brooklyn, N. Y.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Magnet Wire
Amer. Insulating Mach'y Co., Phila., Pa.
Elevator Supplies Co., Inc., Rahway, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Material Handling
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MACHINERY — Measuring Wire & Cable
Davis, R. L., Electric Co., Wallingford, Conn.
New England Butt, Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Glader, Wm., Machine Works Co., Chicago, Ill.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Panning
Amer. Insulating Mach'y Co., Phila., Pa.
Elevator Supplies Co., Inc., Rahway, N. J.

MACHINERY—Pointing
Broden Construction Co., Cleveland, O.
Elevator Supplies Co., Inc., Rahway, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Rod Mill
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Morgan Construction Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
W. A. Schuyler, New York, N. Y.

MACHINERY—Rolling Mill
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Morgan Construction Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Rubber Strip Covering
Farrel-Birmingham Co., Inc., Ansonia, Conn.
New England Butt, Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Rubber Tubing and Straining
Farrel-Birmingham Co., Inc., Ansonia, Conn.
New England Butt, Co., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Screw Wire
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
Amer. Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, O.
Elevator Supplies Co., Inc., Rahway, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

WHERE TO BUY, Continued

MACHINERY— Special — Combination Machine for Drawing, Cutting-to-length. Straightening and Reeling Bars from Coil in One Operation (Shumag Type)—
W. A. Schuyler, New York, N. Y.

MACHINERY—Spooling
Amer. Insulating Mach'y Co., Phila., Pa.
Elevator Supplies Co., Inc., Rahway, N. J.
Fidelity Machine Co., Philadelphia, Pa.
Sleeper & Hartley Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spring Making
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
Broden Construction Co., Cleveland, O.
Hallden Machine Co., Thomaston, Conn.
Lewis Machine Co., The, Cleveland, O.
National Machinery Exchange, New York, N. Y.
H. J. Ruesch Machine Co., Newark, N. J.
W. A. Schuyler, New York, N. Y.
F. B. Shuster, New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Stranding
New England Butt, Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Broden Construction Co., Cleveland, O.
H. J. Ruesch Machine Co., Newark, N. J.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Swaging
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Taping
Amer. Insulating Mach'y Co., Phila., Pa.
Elevator Supplies Co., Inc., Rahway, N. J.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt, Co., Providence, R. I.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Testing Size of Wire
Davis, R. L., Electric Co., Wallingford, Conn.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Tinsel Rolling Mills
Amer. Insulating Mach'y Co., Phila., Pa.

MACHINERY—Trolley Wire
Vaughn Machinery Co., Cuyahoga Fall, O.

MACHINERY—Tube Mill
H. J. Ruesch Machine Co., Newark, N. J.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Welding Wire
Micro Products Co., Chicago, Ill.
F. B. Shuster Co., New Haven, Conn.
Thomson-Judd Wire Machinery Co., Lynn, Mass.

MACHINERY—Winding
Amer. Insulating Mach'y Co., Phila., Pa.
Elevator Supplies Co., Inc., Rahway, N. J.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt, Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Drawing
Amer. Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, O.
Elevator Supplies Co., Inc., Rahway, N. J.
Morgan Construction Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.
W. A. Schuyler, New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Wire Rope
New England Butt, Co., Providence, R. I.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Tinning
Amer. Insulating Mach'y Co., Phila., Pa.
Elevator Supplies Co., Inc., Rahway, N. J.

MACHINERY—Wrapping Wire
Elevator Supplies Co., Inc., Rahway, N. J.
W. A. Schuyler, New York, N. Y.

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MILLS—Tandem Rolling and Edging
Torrington Mfg. Co., Torrington, Conn.

MONORAIL SYSTEMS—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

NICKEL SILVER AND PHOSPHOR BRONZE—Rod, Wire and Strip
Hudson Wire Co., Ossining, N. Y.
Seymour Mfg. Co., The, Seymour, Conn.

PANS—Lead Melting
Trenite Corp., Trenton, N. J.

PAPER—Insulating
E. W. Twitchell, Inc., Phila., Pa.

PATENT ATTORNEYS—
Lancaster, Allwine and Rommel, Washington, D. C.

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.

PIPING AND FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

POTS—Lead Melting
Farrel-Birmingham Co., Inc., Ansonia, Conn.
John Robertson Co., Brooklyn, N. Y.

PRESSES—Hydraulic and Mechanical
John Robertson Co., Brooklyn, N. Y.

PRESSES—Lead
John Robertson Co., Brooklyn, N. Y.

PULLERS—Wire
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

PUMPS—Hydraulic
John Robertson Co., Brooklyn, N. Y.

PYROMETERS—
Leeds & Northrup Co., Philadelphia, Pa.

RECORDERS—
Leeds & Northrup Co., Philadelphia, Pa.

REEL AND TENSION STAND—
Fidelity Machine Co., Philadelphia, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS AND SPOOLS—Shipping and Shop
Apco-Mossberg Co., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REFRACTORIES—High Temperature
Norton Co., Worcester, Mass.

RODS—Wire—Non Ferrous
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.
Seymour Mfg. Co., The, Seymour, Conn.

RODS—Wire—Steel
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

ROLLS—
Farrel-Birmingham Co., Inc., Ansonia, Conn.

RUST PROOF COMPOUND—
American Lanolin Co., Lawrence, Mass.

SHEET—Steel
Republic Steel Corp., Cleveland, O.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

SKIN PROTECTOR—
Magnus Chemical Co., Garwood, N. J.

SOAPS—Industrial and Wire Drawing
Magnus Chemical Co., Garwood, N. J.

STRIP—Brass, Zinc and Non Ferrous
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.
Seymour Mfg. Co., The, Seymour, Conn.

STRIP—Steel
Firth-Sterling Steel Co., McKeesport, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
Republic Steel Corp., Cleveland, O.

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TANKS—Pickling
Haveg Corp., Newark, Del.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

TREADS—Safety
Norton Co., Worcester, Mass.

TRUCKS
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Fall, O.

TUBE BENDERS AND FORMERS—
H. J. Ruesch Machine Co., Newark, N. J.

VALVES AND FITTINGS—Acid Proof
Duriron Co., The, Dayton, O.
Haveg Corp., Newark, Del.

VULCANIZERS—
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS—
Amer. Insulating Mach'y Co., Phila., Pa.

WELDERS—Snot and Butt
Micro Products Co., Chicago, Ill.

WIRE—Cold Heading
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Republic Steel Corp., Cleveland, O.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

WIRE—Electric
Hudson Wire Co., Ossining, N. Y.
Seymour Mfg. Co., The, Seymour, Conn.

WIRE—Enameled For Coils
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Manufacturers
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Republic Steel Corp., Cleveland, O.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

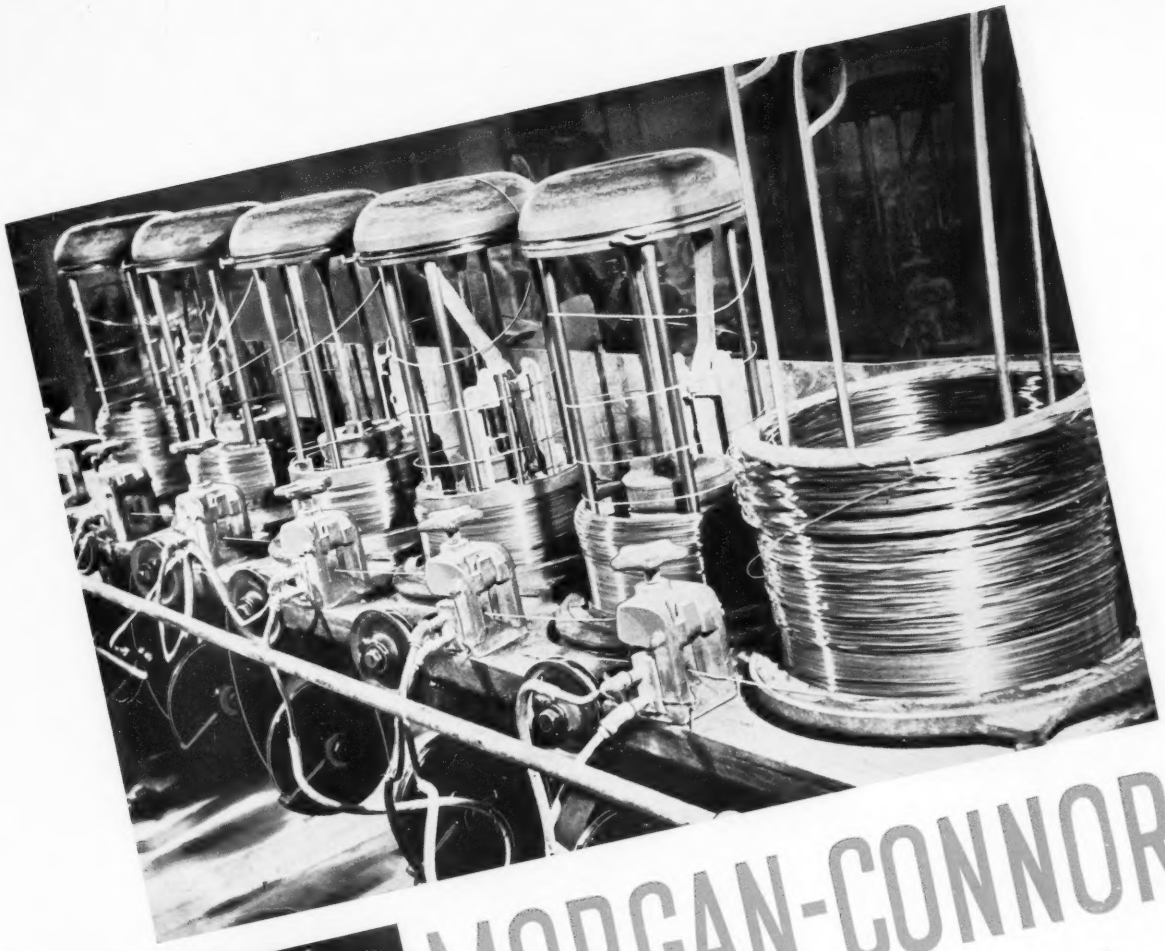
WIRE—Nickel Silver and Phosphor Bronze
Hudson Wire Co., Ossining, N. Y.
Seymour Mfg. Co., The, Seymour, Conn.

WIRE—Non Ferrous to Specification For Special Purposes
Hudson Wire Co., Ossining, N. Y.
Seymour Mfg. Co., The, Seymour, Conn.
Winsted Div. of Hudson Wire Co., Winsted, Conn.

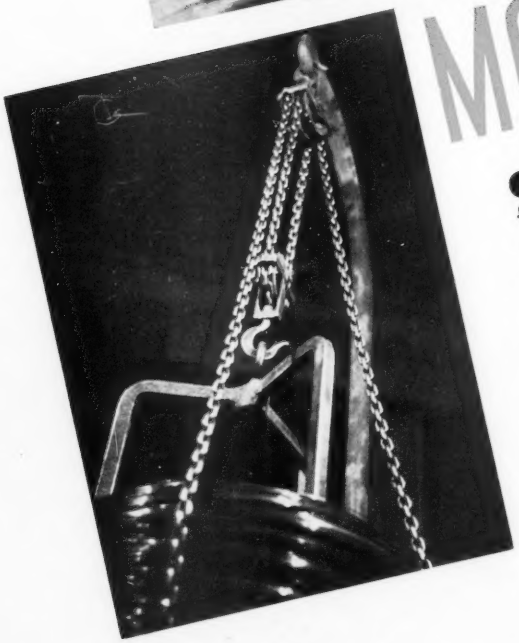
WIRE—Spring
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

WIRE—Steel—Also Coppered Steel—Also Galvanized Steel
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Republic Steel Corp., Cleveland, O.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

WIRE AND STRIP—Brass, Zinc
Platt Bros. & Co., The, Waterbury, Conn.



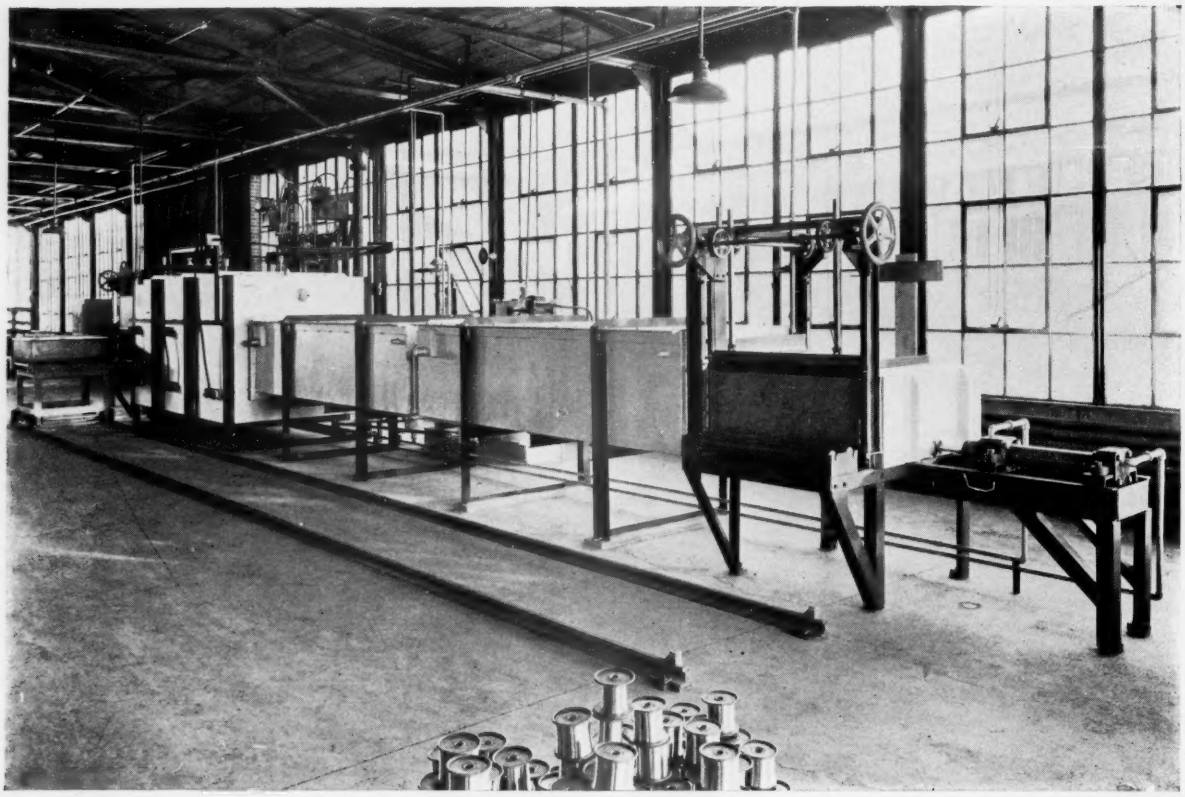
MORGAN-CONNOR



● High production per man-hour and per unit of floor space is an important feature of Morgan-Connor Wire Machines. Their unique system of wire storage and air cooling permit greater drawing speeds on high and low carbon stock with a minimum of attention and manual effort. They are compact, sturdy and designed for long service. Morgan Construction Co., Worcester, Mass., U. S. A.

Continuous Wire Drawing Machinery

Sole European Representatives—Malmedie & Co., Dusseldorf, Germany.



Another Continuous Controlled Atmosphere Furnace For

Bright Annealing Fine Copper Wire

- - Continuously and Economically

The above furnace, for bright annealing fine copper wire on spools, was recently installed in a prominent eastern plant and is the second continuous, special atmosphere furnace for this purpose we built for this same company. — another repeat order.

Repeat orders are only placed by satisfied customers.

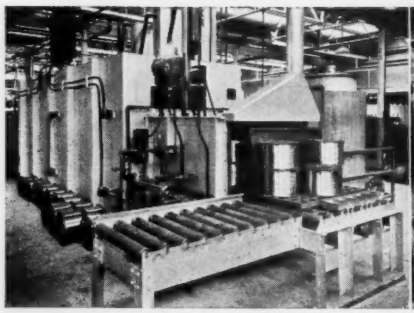
We have also made a number of other interesting installations for bright annealing both heavy and fine copper wire on large reels, on small spools and in coils. Three of these installations are shown below.

In addition to the numerous furnaces we have built for bright annealing copper wire, we have made a number of outstanding installations for bright annealing steel wire, normalizing and spheroidizing rod, clean annealing brass wire and for bright and clean annealing other ferrous and non-ferrous products, including tubing, strip, sheet, stampings and other finished and unfinished products — continuous furnaces for copper brazing, scale-free heat treating, normalizing, carburizing, nitriding, billet heating, heating for forging and other processes.

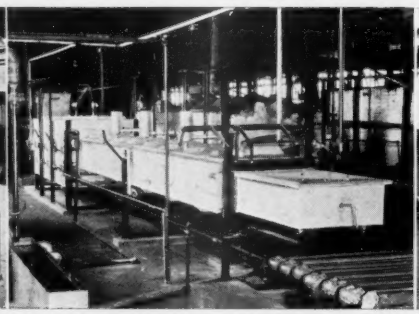
We specialize on building furnaces to fit the customer's specific requirements. Our engineers will be glad to work with you on any of your furnace or heat treating problems.

The Electric Furnace Co., Salem, Ohio

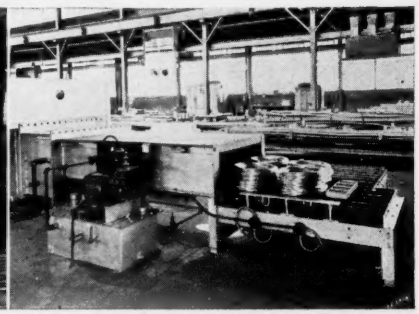
Gas Fired, Oil Fired and Electric Furnaces --- For Any Process, Product or Production



Copper wire on large reels is bright annealed in this continuous furnace — capacity 36,000 lbs. per day. The wire comes out uniformly annealed, bright and dry.



Bright annealing fine copper wire on small spools. This furnace handles 10,000 lbs. per day. All these furnaces can be built in larger or smaller sizes.



Charging end of another continuous, controlled atmosphere electric furnace for bright and clean annealing large coils of bronze, copper and nickel-silver wire.